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# AEROSPACE MEDICINE AND BIOLOGY

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## A CONTINUING BIBLIOGRAPHY

### WITH INDEXES

### (Supplement 94)

### OCTOBER 1971



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

## ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges:

STAR (N-10000 Series)     N71-29201—N71-31600

IAA (A-10000 Series)     A71-34173—A71-37070

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# **AEROSPACE MEDICINE AND BIOLOGY**

**A CONTINUING BIBLIOGRAPHY  
WITH INDEXES**

**(Supplement 94)**

**A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA Scientific and Technical Information System during September 1971.**



*Scientific and Technical Information Office*

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**

**WASHINGTON, D.C.**

**OCTOBER 1971**

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# INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* (NASA SP-7011) lists 393 reports, articles, and other documents announced during September 1971 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964; since that time, irregular supplements have been issued.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied by an abstract. The listing of the entries is arranged in two major sections: *IAA Entries* and *STAR Entries*, in that order. The citations and abstracts are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

Two indexes—subject and personal author—are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1971 Supplements.

# AVAILABILITY OF CITED PUBLICATIONS

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All publications abstracted in this bibliography are available to the public through the sources as indicated in the *STAR Entries* and *IAA Entries* sections. It is suggested that the bibliography user contact his own library or other local libraries prior to ordering any publication inasmuch as many of the documents have been widely distributed by the issuing agencies, especially NASA. A listing of public collections of NASA documents is included on the inside back cover.

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## TYPICAL CITATION AND ABSTRACT FROM STAR

NASA SPONSORED DOCUMENT		AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER	N71-11094*# Yeshiva Univ., New York.	CORPORATE SOURCE
TITLE	A STUDY OF THE STABILITY OF SLEEP PATTERNS IN YOUNG ADULTS FOR SEQUENTIAL NIGHTS OVER A THREE WEEK PERIOD Final Report, 15 Jun. 1968-15 Jun. 1970	PUBLICATION DATE
AUTHOR	Elliot D. Weitzman 15 Jun. 1970 27 p refs (Grant NGR-33-023-032)	AVAILABILITY SOURCE
CONTRACT OR GRANT	(NASA-CR-111519) Avail: NTIS CSCL 06P	COSATI CODE
REPORT NUMBER	In the study reported each subject had a three week baseline nocturnal sleep period, followed by three weeks of sleep during the day, followed by a re-inversion period of three weeks sleeping at night. The data obtained from these studies are described. Author	

## TYPICAL CITATION AND ABSTRACT FROM IAA

NASA SPONSORSHIP		AVAILABLE ON MICROFICHE
AIAA ACCESSION NUMBER	A71-10513 * #	AUTHORS
TITLE	Influence of perturbing effects on a manual rendezvous system. Alan M. Schneider, Howard M. Koble, and Eric T. Wilson (California, University, La Jolla, Calif.). In: The role of man in navigation; Institute of Navigation, Anniversary Year Meeting, 25th, U.S. Air Force Academy, Colorado Springs, Colo., July 1-3, 1970, Proceedings. (A71-10501 01-21) Washington, D.C., Institute of Navigation, 1970, p. 212-252. 6 refs. Grant No. NGR-05-009-106.	AUTHORS' AFFILIATION
TITLE OF PERIODICAL		PUBLICATION DATE
	A system for navigation, guidance, and control of a spacecraft to rendezvous with an orbiting target, based entirely on observations by handheld, unpowered instruments, and computations done entirely by hand, has been developed. This paper describes results of an interactive digital simulation of this system through a selected set of rendezvous missions. A previously reported study to evaluate the influence of error sources on the system is extended to two new test cases. In addition, several perturbing influences not covered heretofore are examined, specifically: errors in the method of star sight averaging made to compensate for nonsimultaneity of a pair of sightings, incorrect knowledge of the interceptor spacecraft's orbital period, and astronaut computation error. An activity chart is included which shows the apportionment of two astronauts' time in carrying out rendezvous using the manual system. It is shown that rendezvous is achieved on all error missions without undue increase in fuel and/or time relative to an 'error-free' mission. (Author)	CONTRACT, GRANT, OR SPONSORSHIP



# AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 94)

OCTOBER 1971

## IAA ENTRIES

**A71-34173** Estimation of the pulmonary diffusing capacity for O<sub>2</sub> by a rebreathing procedure. J. Piiper, P. Cerretelli, D. W. Rennie (Max-Planck-Institut für experimentelle Medizin, Göttingen, West Germany), and P. E. di Prampero (Milano, Università, Milan, Italy). *Respiration Physiology*, vol. 12, June 1971, p. 157-162. 6 refs.

A theory of the gas-blood partial-oxygen-pressure equilibration occurring in rebreathing is developed. It is shown in theory that the approach of alveolar to mixed venous partial oxygen pressure in rebreathing conditions is determined by the volume of the bag-lung system, the cardiac output, the slope of the O<sub>2</sub> dissociation curve, and by the pulmonary diffusing capacity. Thus, the pulmonary diffusing capacity can, in principle, be determined without blood sampling from the rate of change of alveolar partial oxygen pressure during rebreathing when the other factors are known. M.V.E.

**A71-34174** Effect of a change of perfusion on exit of nitrogen and oxygen from gas pockets. Hugh D. Van Liew (New York, State University, Buffalo, N.Y.). *Respiration Physiology*, vol. 12, June 1971, p. 163-168. 12 refs. USAF-supported research; Contract No. N 00014-68-A-0216.

Measurement of rates of exit of O<sub>2</sub> and N<sub>2</sub> from subcutaneous gas pockets in rats while tissue blood flow was elevated due to injections of cobalt chloride. Exit rate of N<sub>2</sub> doubled, whereas O<sub>2</sub> exit rate changed only slightly. Blood flow was estimated to have increased fourfold. These findings are in accordance with theoretical predictions that inert gas uptake is proportional to the square root of perfusion rate but that O<sub>2</sub> uptake depends on local metabolic rate and is independent of perfusion. Comparison of O<sub>2</sub> and N<sub>2</sub> exit rates allows estimation of the diffusion limitation of tissue-to-blood exchange. For N<sub>2</sub>, blood appears to come only 50 to 75% of the way to equilibrium as it passes through capillaries of the tissue around the gas pocket. (Author)

**A71-34175** Reflex increase in ventilation induced by vibrations applied to the triceps surae muscles in the cat. L. M. Leitner and P. Dejours (CNRS, Laboratoire de Physiologie Respiratoire, Strasbourg, France). *Respiration Physiology*, vol. 12, June 1971, p. 199-204. 14 refs.

In cats, either decerebrate or lightly anesthetized with fluothane, bilateral stimulation of the triceps surae by vibration evoked an increase in ventilation shortly after the start of the stimulus. Principally the tidal volume increased. The primary afferent endings of the muscle spindles stimulated by the vibratory stimulus, together with other muscular and articular receptors and probably

some cerebral influence, are responsible for the sudden change in ventilation which appears at the beginning of a muscular exercise. M.V.E.

**A71-34176** Origin and regulation of spontaneous deep breaths. D. Bartlett, Jr. *Respiration Physiology*, vol. 12, June 1971, p. 230-238. 21 refs. PHS Grant No. HE-02888(14).

The physiological regulation of the deep, sighing breaths, which are a consistent feature of normal mammalian respiration, were investigated in unanesthetized and anesthetized rats. The results obtained indicate that the spontaneous sigh is a complex response to lung inflation, brought about by a vagally mediated mechanoreflex, which is regulated by afferent information from peripheral chemoreceptors. M.V.E.

**A71-34219 #** Timely questions in the research on blood regeneration mechanisms (Aktual'ni pitannia doslidzhennia mekhanizmv regeneratsii krovi). Ia. G. Uzhans'kii (Sverdlovskii Medichnii Institut, Sverdlovsk, USSR). *Fiziologichnii Zhurnal*, vol. 17, May-June 1971, p. 315-320. 30 refs. In Ukrainian.

Consistent account of experimental research on Bogomolets' (1935) hypothesis about the role of erythrocyte disintegration products in the mechanism of blood regeneration. Data are given for the progressive reduction of erythrocyte blood counts after loss of blood in animals, the morphological destruction of erythrocytes in organs, and the reduced resistance and shortened lifetimes of erythrocytes in the posthemorrhage period. These data are used to substantiate the hypothesis for a close genetic relationship between erythropoiesis and erythrodiuresis. This relationship is demonstrated for different forms of hypoxia, and a new understanding of the effects of hypoxia on blood regeneration is discussed. T.M.

**A71-34220 #** State of tissue oxygen supply and the factors which affect it in advanced and old age (Pro stan kisnevogo postachannia tkanin ta faktori, shcho iogo viznachaiut', u pokhilomu ta starechomu vitsi). O. V. Korkushko and L. O. Ivanov (Akademii Meditsinskikh Nauk SSSR, Kiev, Ukrainian SSR). *Fiziologichnii Zhurnal*, vol. 17, May-June 1971, p. 364-370. 32 refs. In Ukrainian.

The oxygen tension in the subcutaneous tissue of the left forearm and the oxygen saturation of arterial blood were measured in 152 relatively healthy people of advanced and elderly age and in a control group of 29 healthy persons from 19 to 32 years of age. It is shown that oxygen supply of subcutaneous tissue becomes disturbed during aging. To a large extent, this is due to the impairment of blood oxygenation in the lungs. Another factor responsible for this effect is the changed state of circulatory functions. An analysis of capillary-tissue diffusion of oxygen indicates that disturbed capillary circulation is important in the development of hypoxia during aging. T.M.

**A71-34221 # Comparative characteristics of anoxybiotic processes in the tissues of heterothermal and homoiothermal animals during prolonged hypoxia (Porivnial'na kharakteristika anoksibiotichnikh protsesiv u tkaninakh geterotermnikh i gomoiotermnikh tvarin pri trivalii gipoksii).** N. M. Shumits'ka and E. V. Kolpakov (Akademiia Nauk Ukrain's'koi RSR, Institut Fiziologii, Kiev, Ukrainian SSR). *Fiziologichnii Zhurnal*, vol. 17, May-June 1971, p. 379-384. 45 refs. In Ukrainian.

Comparative studies were performed on heterothermal (susliks) and homoiothermal (white rats) rodents. The hemopoiesis and the activity of anoxybiotic processes (anaerobic and aerobic glycolysis) in the cerebral hemispheres and skeletal muscles were studied during a preliminary two-week exposure to a hypoxia level equivalent to an altitude between 6000 and 8500 m. In rodents adapted to hypoxia, intensified hemopoiesis (particularly in rats and to a lower measure in susliks) was accompanied by changes in the content of preformed lactic acid in the brain tissues. Enhanced activity of anoxybiotic processes was discovered in the brain tissues of adapted animals. No disturbances of the direct Pasteur effect were observed. The apparent differences in the reactions of the two species of animals can be attributed to ecological factors. T.M.

**A71-34222 # Influence of increased oxygen content in the ambient medium on the lungs of animals (Vpliv pidvishchenogo vmistu kisniu v navkolishn'omu seredovishchi na legeni tvarin).** G. V. Troshikhin (Akademiia Nauk SSSR, Institut Fiziologii, Leningrad, USSR). *Fiziologichnii Zhurnal*, vol. 17, May-June 1971, p. 397-401. 25 refs. In Ukrainian.

Study of the influence of increased oxygen concentrations (60, 80, and 90% oxygen) on the pulmonary tissues of mice during prolonged exposures of 1.5, 3, 5, 10, and 15 days. After-effects were also observed after periods of 6 hrs, and 1, 3, and 5 days following the exposure. The animals endured the 60% hyperoxic mixture comparatively well; initial symptoms of inflammation were observed only after a 10-day exposure, and these diminished with further exposure. Exposure to 80% oxygen for 36 hr evoked a distinct inflammatory reaction with edematous effects in some of the mice. A 90% oxygen exposure evoked the same types of lung changes but these were more serious. A 7-day exposure to this mixture resulted in the death of some animals and evoked both pneumonia and acute pulmonary edema. Reversal of the symptoms of 90% oxygen exposure occurred after the third day of breathing with a normal mixture. T.M.

**A71-34223 # Experimental demonstration of the existence of a parallelism between disturbances of the energy metabolism and the content of specific components of the connective tissue in arterial vessel walls (Eksperimental'ni dokazi isnuvannia paralelizmu mizh porushenniami energetichnogo obminu ta vmistom spetsifichnikh komponentiv spoluchnoi tkanini v stintsii arterial'nikh sudin).** Iu. V. Bits' (Kiivs'kii Medichnii Institut, Kiev, Ukrainian SSR) and V. P. Perfilov (Kiivs'kii Institut Udoskonalennia Likariv, Kiev, Ukrainian SSR). *Fiziologichnii Zhurnal*, vol. 17, May-June 1971, p. 416-420. 17 refs. In Ukrainian.

Inhibitors of the energy metabolism were administered to rabbits subjected to parallel measurements of the oxygen uptake of an isolated aorta tissue and of the content of dissolved and undissolved collagen fractions in this tissue. It is shown that the reduced oxygen uptake resulting from the use of the inhibitors is accompanied by growth of undissolved collagen in the aorta. T.M.

**A71-34352 Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, September 22-27, 1969, Proceedings.** *Ergonomics*, vol. 14, Jan. 1971. 180 p.

The purpose of the symposium was to bridge the gaps in current methods of fatigue research among different countries. The papers

deal with various features of fatigue assessment from the physiological and psychological viewpoints, and are presented under the classifications of fatigue in industry, fatigue assessment in relation to industrial conditions, and assessment criteria for mental fatigue.

Individual items are abstracted in this issue.

F.R.L.

**A71-34353 Understanding fatigue in modern life.** R. A. McFarland (Harvard University, Boston, Mass.). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 1-8; Discussion, p. 9, 10. 7 refs.

Consideration of the problem of fatigue, with emphasis on chronic fatigue which is not relieved by rest or sleep, and is cumulative in its effects. Where no organic basis for the condition exists, attention must be directed towards finding the most likely cause and making the necessary changes in the schedule of living and way of life. Recommendations include adequate sleep; the establishment of a daily work-rest cycle acceptable to the individual; the elimination of conditions resulting in excessive stress, anxiety, or boredom; institution of a definite schedule of physical exercise; and the possible use of stimulants or medication. For the organizational control of fatigue the coordinated effects of medical and administrative departments are needed. F.R.L.

**A71-34354 A model of fatigue.** N. Tsaneva (Scientific Research Institute for Labor, Sofia, Bulgaria) and S. Markov (Sofiiski D'rzhaven Universitet, Sofia, Bulgaria). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 11-15; Discussion, p. 16. 8 refs.

A model of fatigue is proposed based on permeability changes in the synaptic membranes and a feedback regulation due to metabolic changes in the working organ as well as in the whole organism. The model is described by mathematical equations which permit its quantitative study by means of a digital computer. (Author)

**A71-34355 Psychological rating of human fatigue.** S. Kashiwagi (Railway Labor Science Research Institute, Tokyo, Japan). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 17-20; Discussion, p. 21. 5 refs.

Attempt, by means of a factor analytic study, to construct a fatigue-rating (FR) scale which allows a judgement of human fatigue through the appearance and comportment of an individual. Twenty-eight items for the prospective FR scale were prepared, combined with 20 items of a fatigue scale which had been factor-analytically classified into two groups: 'weakened activation' and 'weakened motivation.' An FR scale was constructed which appears to be very practical in the sense of its wide applicability to the study of human fatigue. F.R.L.

**A71-34356 The blink method as an assessment of fatigue.** T. Fukui and T. Morioka (Tokushima University, Tokushima, Japan). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 23-29; Discussion, p. 30. 7 refs.

A moving object is best recognized by looking with repeated rapid blinks as compared with the usual method of looking. Blinking is associated with the function of the eyelids and oculomotor muscles, retina, optic nerve and cerebrum. Hence, the blink value may be an indication of the total functioning of these organs and the autonomic nervous system. A method of measuring the blink value is presented, which enables rapid and accurate measurement of fatigue in the whole body. (Author)

**A71-34357** Fatigue from the point of view of urinary metabolites. F. N. Dukes-Dobos (U.S. Public Health Service, Bureau of Occupational Safety and Health, Cincinnati, Ohio). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 31-41. 25 refs.

Review of studies on urinary excretion of proteins, electrolytes, simple compounds and hormones from the point of view of how changes occurring in the excretion of these metabolites relate to fatigue. Mainly because of the great individual variability which manifests itself not only in the magnitude of response but also in the direction of change, no consistent relationship has been established between the excretion of any of these substances and fatigue. Other variables which may cause inconsistent results if not under control are circadian rhythm, food and fluid intake, the volume of excreted urine and of sweat, climatic conditions, the time intervals between taking urine samples, and the subject's state of acclimatization and training. Studies performed on the urinary microproteins suggest that the excretion rate of this substance is an indicator of the speed of catabolic processes in the body, reflecting the balance of the total neuroendocrine response to stress. F.R.L.

**A71-34358** Direct estimation of circulatory fatigue using a bicycle ergometer. H. Donoso (Universidad de Chile, Santiago, Chile), E. Apud (National Health Service, Institute of Occupational Health, Santiago, Chile), and N. P. V. Lundgren (National Institute of Occupational Health, Stockholm, Sweden). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 53-60. 10 refs.

Suggestion that circulatory strain during shift work be evaluated on the basis of determination of the pulse rate/oxygen intake ratio at two different loads on the bicycle ergometer in a neutral room temperature at the beginning and at the end of the working day. The procedure is safe, simple, and not unpleasant even for elderly subjects and people unfamiliar with the bicycle. However, the output of data is low, limiting its applications to a reduced number of subjects. In the present study no circulatory strain was demonstrated. This was in agreement with the fact that the work load according to the Christensen schedule modified for Chilean conditions was moderate for the kind of operation studied and that the climatic conditions of the work were not unfavorable. (Author)

**A71-34359** Mechanical and physiological efficiency of muscular work with different muscle groups. M. Morioka, K. Numajiri, N. Onishi, and N. Sasaki (Institute for Science of Labor, Tokyo, Japan). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 61-67; Discussion, p. 68, 69. 5 refs.

Investigation of the relationship between work load and maximum duration of exercise on three types of muscular work: reciprocating flexion-and-extension of forearm, cranking by both arms, and bicycle pedalling. At the submaximal workload the maximum duration was closely related to the ratio of torque to the respective maximum muscle strength along with the speed of the work. With reference to physiological efficiency, some physiological responses such as the bounds of steady state and the terms of recovery in heart rate, ventilatory equivalent and oxygen debt were compared in relation to the oxygen requirement at various load levels. The work load and the level of energy expenditure at which the physiological burden can be assessed to be equivalent among the different types of muscular work are connected with the substantial mass of working muscle groups. F.R.L.

**A71-34360** Experimental studies of muscular fatigue of Bengalees with increasing work loads under different environmental conditions. S. R. Maitra and S. N. Koyal (Calcutta, University,

Calcutta, India). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 71-84. 20 refs. Research supported by the Council of Scientific and Industrial Research of India.

Study of the effects of increasing work load by 1 kg/sec/min, measured on Müller's magnetic-type bicycle ergometer, on healthy males under different environmental conditions. Experiments in a hot, humid environment and a comfortable environment were performed, and effects of ventilation, heart rate, oxygen consumption, oxygen pulse, extraction ratio, and blood lactate concentration, etc., were noted. The results show that increasing the work load produces fatigue by stressing cardiac activity to the limit; other parameters have some reserve capacity. F.R.L.

**A71-34361** The measurements of fatigue in hot working conditions. R. B. Welch, E. O. Longley, and O. Lomaev. (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 85-88; Discussion, p. 89, 90.

Results of testing a number of subjects wearing three different types of self-contained breathing apparatus in a heat chamber, performing a work cycle of two minutes duration, followed by a three minute rest period, at temperatures of 30, 35, 38, and 41 C (dry bulb) with a wet bulb temperature about 1 deg lower in each case. The tests were continued until the subject was either unable to continue or until the rectal temperature reached 38.8 to 38.9 C. For comparison, experiments were carried out with subjects wearing no equipment. Pulse rates, skin temperature, and sweat losses were also recorded. The experiments confirmed that a rectal temperature of 38.8 to 38.9 will, in most cases, coincide closely with the onset of exhaustion. Sweat loss and pulse rate were found to be unreliable methods of measuring fatigue, and skin temperature was completely unreliable as an index of fatigue except when the temperature and humidity were high. F.R.L.

**A71-34362** A factor-analytic study of phase discrimination in mental fatigue. K. Kogi and Y. Saito (Railway Labor Science Research Institute, Tokyo, Japan). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 119-125; Discussion, p. 126, 127. 9 refs.

Attempt to discriminate phases in the course of the diurnal variation of cortical functions in operators of a control center. Critical flicker fusion frequency was measured at different periods of a 34-hr shift. Correlation coefficients among periods were computed and three underlying factors were extracted by factor analysis (principal component analysis and varimax rotation). Distribution of observed fusion frequencies was not normal in the phases of night or intermediate factors. It is concluded that phase discrimination of cortical functions by means of factor analysis would be useful for detecting overfatigued conditions. F.R.L.

**A71-34363** A telemetric method for assessing mental performance. N. Hamar and E. Novák (Országos Munkaegészségügyi Intézet, Budapest, Hungary). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 129-135.

Description of an improved telemetric accelerograph which has been shown to be an effective instrument for assessing mental performance under industrial working conditions if the work is characterized by periodically repeated stereotyped movements. The new instrument comprises perceptive FM transmitting sets attached to the right and left wrists, two single-channel FM receivers, antennas, and a recorder. Each receiver is fitted with a device for filtering hf components. Analysis of the accelerogram from the point of view of time and structure indicates that it can assess changes in mental performance during shift work. F.R.L.



**A71-34364**      **Physiological parameters of mental load.** J. H. Ettema and R. L. Zielhuis (Amsterdam, University, Amsterdam, Netherlands). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 137-143; Discussion, p. 144. 8 refs.

Discussion of an experiment where a simple binary choice task is used with several frequencies of signals to be answered, thus providing different mental loads. Systematic changes were found in heart frequency, sinus arrhythmia, systolic and diastolic blood pressure, rate of respiration, etc. It is considered that these changes are due to a simultaneous rise in sympathetic tone and vagal tone.

F.R.L.

**A71-34365**      **Fatigue and stress in air traffic controllers.** E. P. Grandjean, G. Wotzka, R. Schaad, and A. Gilgen (Swiss Federal Institute of Technology, Zurich, Switzerland). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 159-163; Discussion, p. 164, 165.

Results of measurement of fatigue on 68 air traffic controllers, using the methods of critical fusion frequency (CFF), tapping test, grid tapping test, and self-rating. Stress was measured on the basis of a questionnaire and of catecholamine in the urine. The four fatigue tests showed significant agreement. There was a marked decrease in the values after the 6th hour of work. During the night hours the test values were lower and the subjects stated they were more tired. In difficult situations nearly all subjects felt nervous, tense, and irritated. Some were anxious and trembling, had increased pulse rate and heart ache, and suffered from insomnia and chronic fatigue. Urine samples from six subjects were taken after normal office work, easy ground control work, and radar air traffic control. There was a significant increase in the catecholamines in the last condition. F.R.L.

**A71-34366**      **An analysis of eye movements during a visual task.** A. Ohtani (Industrial Products Research Institute, Tokyo, Japan). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 167-174.

The distributions of the interval of saccadic movements during different visual situations were analyzed. These distributions were composed of three kinds of movement which have different properties; involuntary, voluntary and fixation. Involuntary movements occurred when a subject ran his eyes along a line, or when he searched some targets on an object. Also, corrective movements to a fixation point were considered as involuntary. The interval of these movements was less than 270 msec. When the subject voluntarily moved his eyes among targets in succession, the intervals were distributed from about 270 msec to 500 msec. In the case of more than about 500 msec, the subject gazed at a target carefully, or he was not required to see any special object. From these results, a side view of a visual task may be inferred from an analysis of the interval of saccadic movements. Furthermore, a criterion for the estimation of the load of a paced visual task, such as an inspection task on a conveyor belt, may be proposed. (Author)

**A71-34367**      **Relations between the symptoms and the feeling of fatigue.** H. Yoshitake (Institute for Science of Labor, Tokyo, Japan). (*Japan Association of Industrial Health, Symposium on Methodology of Fatigue Assessment, Kyoto, Japan, Sept. 22-27, 1969.*) *Ergonomics*, vol. 14, Jan. 1971, p. 175-185; Discussion, p. 186. 8 refs.

Assessment of the work load of bank clerks and broadcasting workers by allowing them to rate the degree of their feeling of fatigue using a 9-point scale ranging from 'feeling fit, rested' to 'feeling extremely tired, exhausted.' The results of this rating were investigated in relation to the subjective symptoms test of fatigue.

There was found to be a high correlation between the frequency of complaints of fatigue and the feeling of fatigue, and that the amount of feeling of fatigue is different for the type of symptom. The more the complaints of symptoms of fatigue, the greater is the degree of feeling of fatigue. This relation is nearly linear over most of the scale. It is considered that some change in the quality of the complaints of systems occurs.

F.R.L.

**A71-34448**      **Statistical evaluation of the Doppler ultrasonic blood flowmeter.** Stephen W. Flax, John G. Webster, and Stuart J. Updike (Wisconsin, University, Madison, Wis.). *ISA Transactions*, vol. 10, no. 1, 1971, p. 1-20. 26 refs.

A theoretical and experimental evaluation of the linear relation between blood flow and instrument output is conducted. It is found that the commonly given equation relating flow velocity to Doppler-frequency shift for the Doppler ultrasonic flowmeter, is overly simplified. Another equation which more accurately describes the Doppler-shifted signal, is based on the geometrical relationships between the flow system and ultrasonic transducers, as well as flow profiles of the fluid. Two methods of modifying the flow measurement system to improve the pulsatile flow tracking characteristics are proposed.

G.R.

**A71-34475 #**      **Space biology and medicine (Kosmicheskaia biologiya i meditsina).** V. V. Parin, F. P. Kosmolinskii, and B. A. Dushkov. Moscow, Izdatel'stvo Prosveshchenie, 1970. 224 p. 45 refs. In Russian.

The basic problems of space biology and medicine are discussed, including the development of methods of selecting and training astronauts, ensuring flight safety from the medical standpoint, and maintaining normal life support factors, health, and high efficiency under complex conditions of prolonged sojourn of man in interplanetary space in spacecraft and on planets of the solar system.

A.B.K.

**A71-34479**      **Effects of sounds on the natural nocturnal sleep (Beeinflussung des natürlichen Nachtschlafes durch Geräusche).** Gerd Jansen (Ruhr-Universität, Essen, West Germany). *Nordrhein-Westfalen, Forschungsberichte*, no. 2131, 1970. 48 p. 37 refs. In German.

Experiments were conducted with twelve healthy humans of normal hearing ability. In one series of tests sounds with durations from 300 msec to 30 sec at intensities in the range from 50 to 80 dB were used. The auditory stimuli consisted of white noise or sounds at a certain frequency. The application took place during light and deep sleeping stages, which were determined by EEG. In a second series of experiments the question of affecting the natural sleep by acoustic irradiation of 90 min duration at various times of the night was investigated. It was found that the quality of the sleep before the expected auditory event was diminished. Information containing sounds such as for instance music had a greater effect than other sounds.

G.R.

**A71-34539 #**      **Anatomical load sensing and torso sensitivity studies.** M. Burns and F. Scribano (IIT Research Institute, Chicago, Ill.). *Society for Experimental Stress Analysis, Spring Meeting, Salt Lake City, Utah, May 18-21, 1971, Paper 1823A*. 15 p. Army-sponsored research.

Development of a quantitative method of detecting loads or pressures on various areas of the body. A sensitivity study was conducted to determine pain thresholds in various regions of the torso. A series of experiments are described which were conducted on a group of about 40 subjects, in which concentrated loads were applied to the torso, using a 2-in. grid over the body surface. The

results made it possible to establish a scale of sensitivity values which could be used in designing suspension systems for coupling loads to the body.

F.R.L.

**A71-34609**      **The present and future role of instrumentation systems in medical screening.** Charles A. Broutman (TRW Systems Group, Redondo Beach, Calif.). In: Institute of Electrical and Electronics Engineers and Western Electronic Manufacturers Association, Western Electronic Show and Convention, Los Angeles, Calif., August 25-28, 1970, Proceedings. North Hollywood, Calif., Western Periodicals Co. (WESCON Technical Papers. Volume 14), 1970, p. 12/2 1-12/2 4.

Medical screening techniques using advanced instrumentation, computers and paramedical personnel are emerging as a very promising solution to many problems related to our national crisis in health care delivery. Classical screening activities have concentrated on early disease detection. Future screening activities are expected to include: (1) profile testing, stress testing, development of individual norms and trend analysis for more effective health monitoring and maintenance, and (2) testing for indications of predisposition to disease, hopefully allowing for the application of appropriate preventive measures. The overall cost-effectiveness of screening could be improved by instrumentation systems which are more sensitive, specific, reliable, fail-safe, self-calibrating and have a more rapid throughput capability. Future screening programs will require very extensive developments in new testing techniques, instrumentation engineering and the imaginative application of computer technology.

(Author)

**A71-34644** #      **Procedures for searching the optimal respiration mode (O protsessakh poiska optimal'nogo rezhima dykhaniia).** L. A. Tenenbaum (Akademiia Nauk SSSR, Institut Problem Upravleniia, Moscow, USSR). *Biulleten' Eksperimental'noi Biologii i Meditsiny*, vol. 71, May 1971, p. 17-21. 10 refs. In Russian.

An experimental verification is described of some hypotheses regarding procedures for searching the optimal (from the viewpoint of respiratory muscle work efficiency) respiration mode in live organisms. In experiments with rabbits performed to this end, an artificial feedback system was used that made the resistance to inspiration dependent on the latter's duration length. Controlled change in feedback characteristics made it possible to adjust respiratory conditions over a range encompassing the optimum respiratory mode. The latter was found in each case by varying slowly the static characteristics of the respiratory mode determining the dependence of the respiration parameters on the resistance to inspiration. The experiments did not confirm the hypothesis of uninterrupted (from inspiration to inspiration) search for the optimum respiratory mode.

M.V.E.

**A71-34645** #      **Influence of electric stimulation of the hypothalamus and cerebral cortex on temperature homeostasis in rabbits under conditions of hyperoxia (Vliianie elektrorazdrazheniia gipotalamusa i kory bol'shikh polusharii na temperaturnyi gomeostazis krolikov v usloviakh giperoksii).** I. I. Antonov. *Biulleten' Eksperimental'noi Biologii i Meditsiny*, vol. 71, May 1971, p. 27-31. In Russian.

Temperature shifts in the rabbit organism during stimulation of the hypothalamus and cerebral cortex were studied under increased oxygen pressure. The role of the anterior and posterior hypothalamus regions and their interrelation with the cerebral cortex are discussed in the light of the results obtained.

M.V.E.

**A71-34646** #      **Influence of thyroid hormones on ascorbic acid distribution in the organism in the presence of hypothermia (Vliianie gormonov shchitovidnoi zhelezy na raspredelenie askorbinovoi kisloty v organizme pri gipotermii).** Z. Ia. Dolgova and B. V.

Karatysh (Semipalatinskii Meditsinskii Institut, Semipalatinsk, USSR). *Biulleten' Eksperimental'noi Biologii i Meditsiny*, vol. 71, May 1971, p. 72-74. 20 refs. In Russian.

Hyperthyrosis or hypothyrosis experimentally induced in rats leads to a reduction of the vitamin C content in a number of organs. The development of artificial hypothermia (mild or strong) in conjunction with hyperthyrosis or hypothyrosis is attended by a reduced content of vitamin C in the tissues. The degree of ascorbic acid deficiency in various organs shows definite dependence on the extent of saturation of the organism with thyroid hormones. M.V.E.

**A71-34647** #      **State of the hypothalamo-hypophyseal system following experimental burns (O sostoianii gipotalamo-gipofizarnoi sistemy pri eksperimental'nom ozhoge).** E. A. Moiseev, D. Ia. Shurygin, and V. E. Beliaev (Voenno-Meditsinskaiia Akademiia, Leningrad, USSR). *Biulleten' Eksperimental'noi Biologii i Meditsiny*, vol. 71, May 1971, p. 113-115. 5 refs. In Russian.

Two days after inflicted burns of 21-38% of the skin surface, rabbits showed an activation of neurosecretory processes in supraoptic and paraventricular nuclei of the hypothalamus and a significant admission of the neurosecreta into the main posterior region of the neurohypophysis. Three days after the burn infliction, the neurosecreta production diminishes. At later periods, there occurs either a gradual restoration or degradation of the neurosecretory processes.

M.V.E.

**A71-34648** #      **Ultrasonic method for investigating regional circulation (Ul'trazvukovoi metod issledovaniia regionarnogo krovoobrashcheniia).** B. A. Saakov, V. M. Lube, V. I. Shepotinovskii, and B. P. Titkov (Rostovskii Meditsinskii Institut, Rostov, USSR). *Biulleten' Eksperimental'noi Biologii i Meditsiny*, vol. 71, May 1971, p. 116-119. 11 refs. In Russian.

A bloodless interference-free technique of deep zonal ultrasound sphymography is described that makes it possible to obtain separate and simultaneous information on various parameters of circulation from practically any portion of the vascular network in any area and depth of the body. The technique is based on principles of acoustic bioecholocation.

M.V.E.

**A71-34652**      **Spectral sensitivity of human visual evoked cortical potentials - A new method and a comparison with psychophysical data.** John B. Siegfried (Houston, University, Houston, Tex.). *Vision Research*, vol. 11, May 1971, p. 405-417. 13 refs. Navy-supported research; PHS Grant No. NB-01453.

A method is described for obtaining the spectral sensitivity function from values of the visual evoked cortical potential in man. This method has the advantages of reducing variability and rendering amplitude vs log radiance functions more nearly linear. The resulting spectral sensitivity function is compared with psychophysical data obtained under identical conditions on the same observers, as well as with an existing psychophysical function.

M.V.E.

**A71-34653**      **Mathematical analysis of rhodopsin kinetics.** M. A. Mainster, T. J. White, and C. C. Stevens (Technology, Inc., San Antonio, Tex.). *Vision Research*, vol. 11, May 1971, p. 435-447. 17 refs. DASA Contract No. 01-70-C-0008.

A general solution of a cyclic five-component model of rhodopsin kinetics is presented. The model predicts the concentration of rhodopsin and its intermediates in the range of normal physiological temperatures for retinal irradiances of arbitrary magnitude and with arbitrary spectral and temporal characteristics. The parametrization of the model in terms of experimental data is described. The model is applied to both flash photolysis and extended photolysis in the rat retina. Photoreversibility is considered, and calculations are reported for rhodopsin kinetics at several different temperatures and in the perfused retina.

M.V.E.

**A71-34654**      **Photolysis of metarhodopsin I - Rate and extent of conversion to rhodopsin.** Barbara N. Baker and Theodore P. Williams (Florida State University, Tallahassee, Fla.). *Vision Research*, vol. 11, May 1971, p. 449-458. 8 refs. PHS Grant No. 9 R01 EY 00479-03; AEC Contract No. AT (40-1)-2690.

The photolysis of metarhodopsin I, produced from cattle rhodopsin, is investigated. It is found that the rate of conversion of meta I to rhodopsin has little, if any, dark component - i.e., rhodopsin appears nearly as fast as the meta I absorbs light. This differs from what was found in the studies on meta II where an easily measured dark component exists. Also different from the results on meta II is the fact that no product, analogous to P sub 470, was noticed when meta I was flashed. The extent of photoreversibility of meta I to rhodopsin is also investigated and is found to depend both on pH and temperature. The reversibility is nearly abolished at pH 4 and reaches an upper limit at pH 6.5 or above. M.V.E.

**A71-34655**      **Visual recognition of isolated lower-case letters.** H. Bouma (Eindhoven, Technische Hogeschool, Eindhoven, Netherlands). *Vision Research*, vol. 11, May 1971, p. 459-474. 20 refs.

Perceptual cues mediating recognition of isolated lowercase letters have been investigated in two conditions of marginal reading: from a long distance and in eccentric vision. A high incidence of confusions indicates that observers readily use available cues for arriving at letter responses. Analysis of the confusions leads to perceptual similarities and to common properties that have possibly served as perceptual cues. Dominating similarities are /h k b/, /tilfr/, /e o c/, /aszxe/, /v w/, and /g q/. Properties with high cue values are: (1) vertically ascending and descending parts, (2) slenderness, (3) outer vertical and outer oblique parts, and also outer gaps. M.V.E.

**A71-34656**      **Sinusoidal current and perceived brightness.** Maarten L. Broekhuijsen and Frans T. Veringa (Groningen, Rijks-universiteit, Groningen, Netherlands). *Vision Research*, vol. 11, May 1971, p. 479-483. 5 refs.

A phenomenon is reported that is believed to be due to interaction of a current with neural structures in the retina. Upon injection of a sinusoidal alternating current of properly chosen frequency and amplitude into a person's eye, adapted to and observing a 35 deg diffuse white screen, the visual field seems to darken considerably and to remain darkened for the duration of current injection which usually would be one or even several minutes. A detailed consideration of the phenomenon suggests that the underlying mechanism involves a quite narrow passband, as well as a rather strictly specified adaptational situation. M.V.E.

**A71-34689**      **Neuronal discharges of the ventrolateral nucleus of the thalamus during sleep and wakefulness in the cat. II - Evoked activity.** M. Fillion, P. J. Cordeau (Montréal, Université, Montréal, Canada), and Y. Lamarre. *Experimental Brain Research*, vol. 12, no. 5, 1971, p. 480-508. 38 refs. Medical Research Council of Canada Grant No. MA-2863.

Study of neuronal discharges recorded with extracellular micro-electrodes in the ventrolateral nucleus (VL) of the thalamus in cats immobilized with gallamine during waking (W), slow wave sleep (SWS), and fast wave sleep (FWS). During W the activity is continuous and sustained, but irregular. During SWS it is at a lower frequency and in short duration, high frequency bursts separated by long silent intervals. During FWS the activity is in long duration high frequency bursts. The responses obtained from the neurons to single shock stimuli applied to the brachium conjunctivum (BC) were examined during spontaneous episodes of W, SWS, and FWS. During W the response consists of a single monosynaptic spike followed by a period of silence lasting from 40 to 80 msec. During SWS the response becomes unpredictable. During FWS, the response is identical to that observed in W, but the silent period that follows is of intermediate duration between W and SWS. F.R.L.

**A71-34698**      **The sympathetic nervous system in short-term adaptation to cold.** J. LeBlanc, C. Roberge, J. Vallière, and G. Oakson (Université Laval, Québec, Canada). *Canadian Journal of Physiology and Pharmacology*, vol. 49, no. 2, 1971, p. 96-101. 13 refs. Medical Research Council Grant No. MT-878; Defence Research Board Grant No. 9310-117.

Rats were adapted to cold by 10-min exposure to -20 C every hour during daytime for a total of 27 exposures over a period of 3 days. The significant delayed hypothermia observed in these adapted animals when exposed to severe cold (-16 C) for 4 hr was concomitant with only a 15 per cent increase in oxygen consumption over control animals. Urinary noradrenaline was increased during the second and third day of adaptation and the excretion during the 4-hr test at -16 C was significantly greater in the adapted than in the control group. G.R.

**A71-34699**      **Physiological noise and the missing 6 dB.** C. M. B. Anderson and L. S. Whittle (Ministry of Technology, National Physical Laboratory, Teddington, Middx., England). *Acustica*, vol. 24, May 1971, p. 261-272. 24 refs.

A series of experiments is described which confirms the existence of the 'missing 6 dB' effect. This is shown to consist of a frequency and level dependent discrepancy between free-field and pressure thresholds at frequencies below 1000 Hz. The effect is demonstrated as being caused by the physiological noise produced under a supra-aural earcap. The physiological noise is shown to be vascular in origin, and to be generated within the external auditory meatus. Some practical implications are discussed. (Author)

**A71-34701 #**      **Vibration and human performance.** Walter F. Grether (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). *Human Factors*, vol. 13, June 1971, p. 203-216. 47 refs.

Vibration research is reviewed from the point of view of how this environment stress affects different types of human performance capabilities. The oscillatory motions normally called vibration range from 1-30 Hz, and the motion may be either sinusoidal or random. In terms of subjective discomfort, the lowest tolerance level for vibration occurs at about 5 Hz, the frequency at which resonance of large body organs is most severe. Visual acuity is severely impaired by vibration frequencies in the range of 10-25 Hz. Manual tracking capability is most seriously affected by vibrations at 5 Hz and below, as are other motor capacities. Tasks involving primarily central neural processes, such as reaction time, monitoring, and pattern recognition, are highly resistant to the effects of vibration. (Author)

**A71-34702**      **An experimental evaluation of a method for simplifying electronic maintenance.** Thomas K. Elliott and Reid P. Joyce (Applied Science Associates, Inc., Valencia, Pa.). *Human Factors*, vol. 13, June 1971, p. 217-227. 10 refs. USAF-supported research.

Experiments are described that demonstrate the ability of a technician with little or no training in electronic theory to perform effectively in an operational setting if he is totally dependent on a proceduralized troubleshooting guide to 'tell him every move to make.' 'Proceduralized troubleshooting' denotes a simplified method for isolating malfunctions in technical equipment and for providing a preset routine that controls the selection and sequence of tests and checks so that the result of each test and check determines which test or action is performed next. The job simplification resulting from this technique can be expected to improve performance reliability and widen the pool of available personnel by lowering aptitude requirements for job entry. Of great importance is also the promise of substantial reduction in technician training costs. M.V.E.

**A71-34703**      **Color coding for information location.** William D. Shontz, Gerald A. Trumm, and Leon G. Williams (Honeywell, Inc., Minneapolis, Minn.). *Human Factors*, vol. 13, June 1971, p. 237-246. 8 refs. Contract No. Nonr-4774(00).

Visual search performance was investigated as a function of color-coded and uncoded information location, number of categories coded, number of objects per category, and background clutter. Thirty-three subjects searched 12 areas of modified sectional aeronautical charts for a total of 48 checkpoints. Identification of checkpoints was established with labels plus geographical context information. Color served as a partially redundant code for information location. In general, the findings indicate that color coding for information location is most effective when: (1) many categories of information can or must be coded, (2) colors highly discriminable in peripheral vision are used, and (3) the number of objects per category is kept reasonably small. (Author)

**A71-34704**      **Magnification and microminiature inspection.** George L. Smith and S. Keith Adams (Oklahoma State University, Stillwater, Okla.). *Human Factors*, vol. 13, June 1971, p. 247-254.

Experienced and naive subjects used a binocular microscope to inspect microminiature patterns (O's) containing occasional defective elements (C's). Detection of defective elements was significantly affected by the level of magnification. The performance curves indicate the existence of a level of magnification which will minimize time per correct inspection. This optimum point occurs when the visual angle subtended by the magnified defect is between 9.0 and 12.0 minutes of arc. Both illumination and pattern size affect the absolute level of inspector performance, but the optimum performance point with respect to magnification does not appear to be affected by either. (Author)

**A71-34705**      **The role of payoffs and signal ratios in criterion changes during a monitoring task.** Robert C. Williges (Illinois, University, Champaign, Ill.). *Human Factors*, vol. 13, June 1971, p. 261-266. 8 refs. Research supported by the University of Illinois.

Study in which 48 subjects detected a long-duration (1.7 or 1.3 sec) change in brightness (from a 5 ft-lumen standard to a 4 ft-lumen level) of an electroluminescent panel during a 60-min monitoring session. Signal/nonsignal ratios (1/9 or 1/1) and payoffs (lax, neutral, or strict) were combined factorially in a between-subject design. Signal ratios affected both the percentage of signal detections and the percentage of false-alarm errors. When subjects monitored under the lower signal ratios, a decrease in percentage signal detections occurred over time. Payoffs affected only the percentage false alarms in the higher signal rate conditions. Signal detection theory analyses resulted in a slight decrease in  $d'$  and a marked increase in beta during the watch period. The change in beta was due primarily to the lower signal ratio conditions. Payoffs had no effect on subsequent beta change. It is concluded that signal ratios rather than payoffs play the major role in determining decision performance in simple visual monitoring tasks. (Author)

**A71-34718 \* #**      **Tektite - Experience with an underwater analog of future space operations.** H. H. Watters (NASA, Marshall Space Flight Center, Huntsville, Ala.) and J. W. Miller (NOAA, Rockville, Md.). *American Institute of Aeronautics and Astronautics, Space Systems Meeting, Denver, Colo., July 19, 20, 1971, Paper 71-828*. 6 p. 6 refs. Members, \$1.50; nonmembers, \$2.00.

The Tektite II program of undersea research provided a high fidelity model of many elements of future manned spaceflight operation. A description of the Tektite program is presented, and some of the more significant aspects of undersea and outer space habitation, and the corresponding design implications are emphasized. In particular, specific findings in the areas of mission

structure/crew composition, crew selection, habitat scientific support, communications, time utilization, and leisure time provisions are discussed. O.H.

**A71-34719 #**      **Experience and trends in life support systems for near earth applications.** Harlan F. Brose (United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn.) and John K. Jackson (McDonnell Douglas Astronautics Co., West Huntington Beach, Calif.). *American Institute of Aeronautics and Astronautics, Space Systems Meeting, Denver, Colo., July 19, 20, 1971, Paper 71-827*. 12 p. Members, \$1.50; nonmembers, \$2.00.

A 90-day operational manned test of an advanced regenerative life support system is discussed, and its influence on the design of the environmental thermal control/life support system (ETC/LSS) for the Space Station Prototype now in the detailed design phase is discussed. The influence of the 90-day test results on the design process to achieve a maintainable ETC/LSS with minimum practical weight, power, and volume penalties for earth-orbital manned space missions are reviewed with emphasis on the trends in life support system design. (Author)

**A71-34741**      **Sampling in the human motor control system.** Gyan C. Agarwall (Illinois, University, Chicago, Ill.) and Gerald L. Gottlieb (Presbyterian St. Luke's Hospital, Chicago, Ill.). *IEEE Transactions on Automatic Control*, vol. AC-16, Apr. 1971, p. 180-183. 12 refs. NSF Grant No. GK-17581.

Some results of a physiological investigation of the sampling hypothesis in the human motor control system are presented in this paper. The hypothesis of a proprioceptively open loop system at the initiation of voluntary effort is not supported by data from ankle rotation. No discontinuity in the monosynaptic pathway (primary afferent fiber to alpha motoneuron) is observed during random isometric step tracking using the H reflex as test signal in the gastrocnemius-soleus reflex arc. This would indicate that for the ankle control system, the hypothesis of sampling at the alpha motoneuron, as proposed by Navas and Stark for wrist rotation, is not valid. The sampling behavior in the human motor system, if it exists, must be of the central origin. (Author)

**A71-34785 #**      **Fire-fighter protection.** John P. Meade (USAF, Life Sciences Group, Norton AFB, Calif.). *SAFE Engineering*, vol. 1, 2nd Quarter, 1971, p. 8, 9.

Deficiencies in fire-fighters' proximity protective clothing are examined. It is pointed out that fire fighters cannot function effectively for any length of time with a combination of heavy garments and heat-stress loading. The only way to resolve this problem is to reduce the overall suit weight by utilizing new thermal materials and by making the garments waterproof. A number of specific recommendations for the protective clothing are presented on the basis of a brief analysis of fire-fighting operations. G.R.

**A71-34790 #**      **Development of a model for identification and prediction mechanisms of the control of human pursuit movement (Modellentwicklung für Identifikations- und Vorhersagemechanismen der Kontrolle der menschlichen Folgebewegung).** Jürgen Werner. Darmstadt, Technische Hochschule, Fakultät für Elektrotechnik, Dr.-Ing. Dissertation, 1970. 163 p. 77 refs. In German.

A method of classification of possible prediction systems on a general basis is considered taking into consideration also systems connected specifically with biological problems. A procedure in which temporally successive extrapolations are formed on the basis of an expansion into a Taylor series is used as a model. The extrapolations are evaluated with the aid of a special function. The class of reproduction systems is defined, and an algorithm for identifying signals with a repetitive structure is presented. Predictions

which are superior to the extrapolation can frequently be obtained by using the algorithm. A parallel system for coordinating the possibilities of the prediction in the form of an extrapolation and of a reproduction with those of error correction is developed. The general concept is implemented for the system of eye pursuit movements by simulation on a digital computer. G.R.

**A71-34821 # Active and passive muscular work and heavy energy expenditure (Lavoro muscolare attivo e passivo e dispendio energetico).** G. Janigro and G. Meineri. *Rivista di Medicina Aeronautica e Spaziale*, vol. 33, Oct.-Dec. 1970, p. 471-482. 10 refs. In Italian.

An experimental investigation of passive muscular work in young and healthy subjects revealed an increase in breathing capacity without a parallel increase in oxygen consumption. This means that pulmonary ventilation is not to be ascribed to metabolic factors but rather to reflex phenomena of muscular fascial or articular origin. Such hyperventilation, which in aircraft flying may be enhanced by passive movements caused by the plane's motion and vibrations, may be the cause of hypoxapnia and ensuing consciousness disorders. M.M.

**A71-34822 # Anatomical, clinical and medico-legal considerations on inguinal hernia caused by acrobatic flying (Considerazioni anatomiche e medico-legali sull'ernia inguinale da volo acrobatico).** G. Rotondo and A. M. De Angelis. *Rivista di Medicina Aeronautica e Spaziale*, vol. 33, Oct.-Dec. 1970, p. 483-493. 15 refs. In Italian.

Description of an interesting typical case of external oblique hernia which was clinically ascertained in a military jet pilot during an acrobatic flight. The pathogenic mechanism of the hernia formation is examined, with emphasis on its connection to the effects of the centrifugal accelerations of acrobatic flying. Important medico-legal aspects of this condition, which can be termed correctly an honest-to-goodness professional illness, are discussed, with particular reference to its possible disabling consequences and to establishing a causality relationship with the specific professional activity so that it can be recognized as service connected. M.M.

**A71-34823 # Importance of the behavior of the spatial ventricular gradient in electrocardiography (Preliminary note) (L'importanza del comportamento del gradiente ventricolare spaziale in elettrocardiografia /Nota preventiva/).** E. Busnengo. *Rivista di Medicina Aeronautica e Spaziale*, vol. 33, Oct.-Dec. 1970, p. 494-501. 33 refs. In Italian.

The concept of the spatial ventricular gradient is considered a useful complement in the precise morphological study of an electrocardiographic recording. The analysis of this gradient is suggested, for its more specific use in the practical field, in some particular electrocardiographic situations, such as disturbances in the intraventricular conduction of the stimulus, which are particularly frequent also in normal cardiological clinical situations. M.M.

**A71-34824 # Psychophysical characteristics of private pilots and flight safety (Caratteristiche psico-fisiche di piloti non professionisti e sicurezza di volo).** F. Rossanigo (Aeronautica Militare, Centro di Studi e Ricerche di Medicina Aeronautica e Spaziale, Rome, Italy) and P. Rota. *Rivista di Medicina Aeronautica e Spaziale*, vol. 33, Oct.-Dec. 1970, p. 502-509. In Italian.

Psychosociological and medical evaluation of a group of private pilots taking an examination for their pilot licensing or license renewal. Considerations are made for the purpose of flight safety, in relationship with the psychophysiological characteristics revealed and with the type of flying activity carried out. M.M.

**A71-34940 Response of the Somali donkey to dehydration - Hematological changes.** G. M. O. Maloiy (East African Veterinary Research Organization, Kabete, Kenya) and C. D. H. Boarer (East African Veterinary Research Organization, Muguga, Kenya; Ministry of Agriculture, Food and Fisheries, Central Veterinary Laboratory, Weybridge, Surrey, England). *American Journal of Physiology*, vol. 221, July 1971, p. 37-41. 14 refs.

The effects of dehydration and rehydration on various blood parameters in five donkeys and three zebu steers are reviewed. Increases in plasma osmolality, sodium chloride, hemoglobin, packed cell volume, red blood cells, and plasma proteins were observed in dehydrated animals. Neither dehydration nor rehydration had any observable effect on mean cell hemoglobin. Most of the blood parameters were restored to their normal values within 24 hr after the animals had been rehydrated. M.V.E.

**A71-34941 \* Blood gases in hibernating and active ground squirrels - HbO<sub>2</sub> affinity at 6 and 38 C.** X. J. Musacchia and W. A. Volkert (Missouri, University, Columbia, Mo.). *American Journal of Physiology*, vol. 221, July 1971, p. 128-130. 17 refs. Grant No. NGL-26-004-021.

Venous and arterial blood gases were measured in hibernating and normothermic ground squirrels, *Citellus tridecemlineatus*. A comparison of active and hibernating animals showed that the venous O<sub>2</sub> partial pressures were markedly reduced in hibernation whereas arterial O<sub>2</sub> partial pressures were not. Both arterial and venous CO<sub>2</sub> partial pressure levels were reduced in hibernation. M.V.E.

**A71-34942 Alpha-adrenergic inhibition of immunoreactive insulin release during deep hypothermia.** David Baum (Washington, University, Seattle, Wash.) and Daniel Porte, Jr. (U.S. Veterans Administration Hospital, Seattle, Wash.). *American Journal of Physiology*, vol. 221, July 1971, p. 303-311. 33 refs. Research supported by the Montana Heart Association; PHS Grants No. HD-02531; No. AM-08865; No. AM-12829; No. 1-KY-AM-8865.

The mechanism for the inhibitory effect of deep hypothermia on immunoreactive insulin (IRI) release was investigated in puppies. Despite generation of marked hyperglycemia, plasma IRI remained at base-line levels in hypothermic puppies given glucose infusions. Plasma IRI elevation following glucagon administration was less during hypothermia than with euthermia although plasma glucose increases were similar in both circumstances. However, phenolamine-induced alpha-adrenergic blockade resulted in pronounced plasma IRI rises in hypothermic animals with or without concomitant glucose infusion. By contrast, glucose infusion in euthermic puppies resulted in substantive plasma IRI increases, while phenolamine produced little or no change in IRI. These observations suggest intrinsic adrenergic regulation of plasma insulin. M.V.E.

**A71-34943 Ouabain-insensitive effects of metabolism on ion and water content of red blood cells.** John C. Parker (North Carolina, University, Chapel Hill, N.C.). *American Journal of Physiology*, vol. 221, July 1971, p. 338-342. 28 refs. PHS Grants No. 5 R01-AM-11356; No. 1 KO4-AM-46369.

Some relationships are discussed between cell metabolic state, ion, and water content which are independent of active cation transport. A striking relation between cell hydration and metabolic state exists by virtue of the fact that most glycolytic intermediates are nondiffusible, polyvalent anions. On incubation in substrate-free media, red cells gain water and chloride at the expense of organic phosphates. Reincubation of depleted cells with metabolizable substrates causes an acute loss of water and chloride and a large gain in cation and organic phosphates. With further metabolic repletion, massive cation accumulation occurs, and water again moves inward. The results can be explained in terms of classical osmotic and permeability concepts. M.V.E.

**A71-34944**      **Differentiation of hypothalamic drive and reward centers.** James Olds, William S. Allan (California Institute of Technology, Pasadena, Calif.), and Eduardo Briese (Universidad de los Andes, Mérida, Venezuela). *American Journal of Physiology*, vol. 221, July 1971, p. 368-375. 14 refs. PHS Grants No. MH-16978; No. GM-02031.

Electric stimulation was applied via chronically implanted electrodes in the hypothalamus, and very small probes and stimulating currents were used in order to separate closely associated effects. Separations not previously reported were observed. Three topographically differentiated areas were found in which stimulation would yield one of three effects (feeding, drinking, and reward behavior) without any of the others. A fourth topographically differentiated area where stimulation yielded all three effects was also observed. M.V.E.

**A71-34956 #**      **Redundancy in receptive neuronal nets and analysis of ways of using it in the preparation of new measuring media (Izbytochnost' v retseptivnykh neironnykh setiakh i analiz nekotorykh putei ee ispol'zovaniia dlia postroeniia novykh sredstv izmereniia).** L. E. Pinchuk, G. I. Salov, V. A. Fedorov, and M. P. Tsapenko. In: Utilization of redundancy in information systems (Ispol'zovanie izbytochnosti v informatsionnykh sistemakh).

Edited by N. A. Zheleznov. Leningrad, Izdatel'stvo Nauka, 1970, p. 54-65. 15 refs. In Russian.

Biological analyzer systems are studied as a basis of obtaining measuring systems of a desired accuracy, sensitivity, speed, and reliability under various conditions. The structural and functional organization of the peripheral section of a generalized biological analyzer is examined. A model of a first-order integral receptive field is discussed, and expressions defining the relation between the accuracy of conversion with the principal system parameters are analyzed. It is shown that a set of independent receptive fields whose operative thresholds are similar and have a random nature can serve theoretically as a statistical measure in measuring systems designed by the coincidence method. V.P.

**A71-35039**      **Assessment of cardiac contractility - The relation between the rate of pressure rise and ventricular pressure during isovolumic systole.** Dean T. Mason, Eugene Braunwald, James W. Covell, Edmund H. Sonnenblick, and John Ross (National Heart Institute, Bethesda, Md.; California, University, Davis; California, University, San Diego, Calif.). *Circulation*, vol. 44, July 1971, p. 47-58. 30 refs. PHS Grants No. HE-12373; No. RR-06138.

Experimental demonstration on isolated mammalian myocardium, on the open-chest canine heart, and on conscious patients, that the relation between the rate of pressure rise and the simultaneously occurring pressure during isovolumic contraction is not altered by acute changes in afterload. In contrast, dp-dt (rate of change of left ventricular pressure) at any given level of pressure during isovolumetric contraction and the ratio (dp/dt) CPIP (common developed isovolumic pressure) are markedly sensitive to changes in the level of inotropic state. M.M.

**A71-35040 \***      **Hemodynamic evaluation of glucagon in symptomatic heart disease.** Paul W. Armstrong, Herman K. Gold, Willard M. Daggett, W. Gerald Austen, and Charles A. Sanders (Harvard University; Massachusetts General Hospital, Boston, Mass.). *Circulation*, vol. 44, July 1971, p. 67-73. 16 refs. PHS Grant No. HE-06664; Grant No. NGR-22-016-007.

Glucagon was administered as a 5 mg intravenous bolus in 26 patients. Studies were performed in the Cardiac Catheterization Laboratory and soon after cardiac surgery. When the response to glucagon was compared on the basis of functional classification, patients with class I and II heart disease had a significantly greater increase in cardiac output (+700 ml) than patients with class III and IV heart disease (+100 ml). Isoproterenol augmented cardiac output

by a significantly greater amount (+2500 ml) than glucagon in eight of these patients. It is concluded that glucagon is a less effective inotropic agent than isoproterenol and that glucagon's usefulness is limited in patients with advanced symptomatic heart disease.

(Author)

**A71-35041**      **Comparison of human ventricular activation with a canine model in chronic myocardial infarction.** Thomas M. Daniel, John P. Boineau, and David C. Sabiston, Jr. (Duke University, Durham, N.C.). *Circulation*, vol. 44, July 1971, p. 74-89. 11 refs. NIH Contract No. PH-43-671440; PHS Grants No. HE-11307; No. HE-11309; No. HE-5732; No. HE-5716.

Ventricular activation was studied in 20 patients with ischemic heart disease at the time of surgery for myocardial revascularization. Because most of the activation studies in man were limited to recording of epicardial potentials, a canine model of chronic infarction was also studied. The experimental model of chronic infarction showed epicardial delay to be due to slowed intramyocardial activation rather than to delay in Purkinje conduction. Correlations between electrical and anatomic data in two patients suggested that, within limits, the detailed relationships between infarction and activation established with the canine model could be applied to human infarction to understand the genesis of the epicardial potentials and the ECG. M.M.

**A71-35042**      **New functional concept of valvular mechanics in normal and diseased aortic valves.** Paul D. Stein and William A. Munter (Oklahoma, University, Norman; U.S. Veterans Administration Hospital, Oklahoma City, Okla.). (*American Heart Association, Annual Meeting and Scientific Sessions, 43rd, Atlantic City, N.J., Nov. 12-17, 1970.*) *Circulation*, vol. 44, July 1971, p. 101-108. 5 refs. Research supported by the U.S. Veterans Administration and the Oklahoma Heart Association.

The orifice area of the functioning aortic valve was measured roentgenographically and related to flow across the valve in 27 patients (12 with normal valves). The orifice area of normal valves was linearly related to stroke index and to left ventricular ejection rate. Less than half of the cross-sectional area of the valve was utilized in most patients during the resting state. A larger percentage of the anatomical cross-sectional area was utilized during states of higher flow. Cinematographic studies of porcine valves in vitro showed a comparable flow-dependent orifice size. These results suggest the concept of a functional or physiologic cross-sectional area of the aortic valvular orifice. The anatomic cross-sectional area may be restricted without impingement upon the functional cross-sectional area in states in which flow across the valve is low. (Author)

**A71-35044**      **Dynamic analysis of the pupil with light and electrical stimulation.** Joseph Terdiman (Kaiser Foundation Research Institute, Oakland; California, University, Berkeley, Calif.), James D. Smith (Southern California, University, Los Angeles, Calif.), and Lawrence Stark (California, University, Berkeley, Calif.). *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-1, July 1971, p. 239-251. 40 refs. NIH Grants No. R 01 NB-8546-01.

A television pupillometer and an on-line computer were used to determine the static and dynamic characteristics of the pupillary system in the cat. The characteristics of sphincter and dilator mechanisms were measured with pulse rate modulated electrical stimuli to sympathetic and parasympathetic nerves and found to be similar to the light-driven pupillary response characteristic at high frequencies. Linear and nonlinear features of the response characteristics that were identified include retinal logarithmic operator, neural, neuromuscular, and mechanical saturation, high-frequency third-order dynamics of the motor component with a break frequency at 0.8 Hz, nonminimum phase transport delay of about 0.2 s, and response asymmetry to positive and negative steps of stimulation. (Author)

**A71-35045** A model of eye movements induced by head rotation. Noboru Sugie (Ministry of International Trade and Industry, Tokyo, Japan) and G. Melvill Jones (McGill University, Montreal, Canada). *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-1, July 1971, p. 251-260. 16 refs.

The slow phase of rotational nystagmus compensates fairly well for head rotation, while the quick phase takes place intermittently in the opposite direction to the preceding slow phase. From both frequency and transient responses, it is confirmed that the slow phase velocity is proportional to the output of the semicircular canal, the main transducer of head rotation. The relationship between the canal output and the quick phase is also discussed, and a simple model is proposed in which the quick phase and slow phase are separately generated. In cats under controlled ether anesthesia, it is found that both phases of the rotational nystagmus can be decomposed into primary and secondary components, and a new model of the vestibulo-ocular system is developed which includes the simultaneous influence of these two components. The model is analyzed to find a condition where the summed effect of primary and secondary components of response constituting the slow phase of rotational ocular nystagmus can be made proportional to the canal output. T.M.

**A71-35046** Two-dimensional adaptive model of a human controller using pattern recognition techniques. Dennis W. Gilstad (U.S. Air Force Academy, Colorado Springs, Colo.) and King-Sun Fu (Purdue University, Lafayette, Ind.). *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-1, July 1971, p. 261-266. 10 refs.

A two-dimensional adaptive model of a human operator in a visual-manual compensatory tracking task is proposed. The model is adaptive to changes in gain and/or form of the plant dynamics on each axis, accommodating plant transfer functions of the form (k/s) or (k/s-squared). Pattern recognition is used to sense changes in the control system requiring a change in the model operating mode. The form of the model is derived from consideration of the physiological processes evident in a human controller. It contains separate sections dealing with perception of the control system variables, action taken by the central nervous system (CNS) as a result of the sensory inputs, and the conversion of CNS commands into motions of the controller. The model reflects the influence of the dominant type 2 control strategy on the type 1 strategy when tracking is performed with heterogeneous plant axis dynamics. Tests of the gain adaptive algorithm simulating time invariant human operator performance are described, and the test results presented for types 1 and 2 control situations. Results of pattern recognition tests conducted with model-generated data are also presented. (Author)

**A71-35109** Relationship between the horizontal-vertical illusions for velocity and extent. G. C. Avery and R. H. Day (Monash University, Clayton, Victoria, Australia). *Journal of Experimental Psychology*, vol. 89, July 1971, p. 22-31. 29 refs.

An object moving vertically apparently moves faster than one moving horizontally at the same physical speed. Six experiments were conducted on this horizontal-vertical (HV) velocity illusion using a stimulus display consisting of a lighted L figure and two points of light moving in paths parallel to the two bars, in an otherwise dark field. The experimental results are interpreted as showing that the HV velocity illusion is not secondary to the HV length illusion but has independent determinants. M.M.

**A71-35110** Cockpit display - Users vs. makers. Carolyne Arnoldy. *Information Display*, vol. 8, July-Aug. 1971, p. 27-32. 36.

It is pointed out that such recent technological advances as the Head Up Display, Area Map Navigation, and CRT and electro-luminescent readouts are still largely unutilized. The reasons for this situation are examined giving attention also to the attitude of the

pilots towards the new equipment. Particular problems considered include the reflection of sunlight by the glass faces of the instruments. Approaches to solve these problems are discussed, and a number of advances presently under development are described. G.R.

**A71-35112** Enhancement of visual and auditory evoked potentials during blockade of the non-specific thalamo-cortical system. James E. Skinner (Baylor University; Methodist Hospital, Houston, Tex.) and Donald B. Lindsley (California, University, Los Angeles, Calif.). *Electroencephalography and Clinical Neurophysiology*, vol. 31, July 1971, p. 1-6. 25 refs. PHS Grant No. MH-6415; NIH Grant No. HE-05435; Contract No. Nonr-4756.

Study of the effects of reversible cryogenic blockade of the nonspecific thalamo-cortical system in the region of the inferior thalamic peduncle in cats. The blockade produced an enhancement of short-latency, visual evoked responses in widespread cortical regions (posterior sigmoid, anterior suprasylvian, primary visual, and primary auditory cortices). Both visual and auditory evoked responses were enhanced. Another effect was the enhancement of the first positive peak of the optic tract-elicited cortical response and the third and fourth peaks of the optic radiation-induced potential, implying both a greater transmission through the lateral geniculate body and a greater cortical response to a constant afferent input. These electrophysiological results are correlated with behavioral deficits in response inhibition and directed attention. T.M.

**A71-35113** Visual evoked responses in normal and psychiatric subjects. Costante Vasconetto, Vincenzo Floris, and Cristoforo Morocutti (Siena, Università, Siena, Italy). *Electroencephalography and Clinical Neurophysiology*, vol. 31, July 1971, p. 77-83. 13 refs. Consiglio Nazionale delle Ricerche Grants No. 115/1361/1378; No. 115/1361/4227.

Visual evoked potentials (VEPs) and the cortical recovery cycle were studied in 45 normal subjects, fifteen paranoid schizophrenics, fifteen neurotic depressives, and fifteen psychotically depressed patients. The normals were divided into three age groups. For evaluation of the recovery cycle, the ratio R2/R1 of wave III amplitude was employed. A procedure based on the analysis of covariance was then used for a direct comparison of R2 in different groups. In normal subjects, the VEP showed a progressive increase in amplitude and latency as the subjects became older. A global decrease in the amplitude of the VEP was observed in schizophrenic subjects. Patients with endogenous depression had an evoked response of larger amplitude. It was not possible to detect substantial differences from normal in neurotic depressed patients. The recovery cycle of normal subjects showed a progressive increase in the facilitation period with the progress of age. This facilitation period was very short and almost absent in the three groups of psychiatric patients. T.M.

**A71-35114** Detection efficiency and evoked brain activity - Day-to-day and moment-to-moment fluctuations. Jay Isgur and Arnold Trehub (U.S. Veterans Administration Hospital, Northampton, Mass.). *Electroencephalography and Clinical Neurophysiology*, vol. 31, July 1971, p. 96-98. 8 refs.

The relationship between fluctuations in photically evoked bioelectric brain activity and visual detection efficiency was investigated in two adult males on a moment-to-moment and day-to-day basis by filtering scalp-recorded evoked brain output at the frequency of photic stimulation. Long-term (day-to-day) changes in detection efficiency were very closely and positively correlated with long-term changes in amplitude of evoked brain output. Moment-to-moment fluctuations in detection efficiency were not correlated with moment-to-moment fluctuations of evoked brain output. It is suggested that the scalp-recorded evoked response of the brain reflects changes in general arousal but does not reveal fluctuations in attention by itself. T.M.

**A71-35120 # Primary cardiomyopathy - Clinical spectrum of adult Japanese patients.** Tadashi Koide, Satoru Murao, Iwao Ito, Kenichi Harumi, Hisakazu Yasuda, Tsuguya Sakamoto, Zenichiro Uozumi, Yasuro Sugishita, Kikuo Machida, Shigenori Morooka (Tokyo, University, Tokyo, Japan), and Hideo Ueda. *Japanese Heart Journal*, vol. 12, Mar. 1971, p. 123-137. 29 refs. Research supported by the Mitsui Life Foundation of Welfare.

Eighty cases of primary cardiomyopathy were classified clinically into 4 categories. Fifteen of them were autopsied and their pathological classification was shown. Among these 80, clinical pictures of 15 obstructive and 51 nonobstructive cases were outlined. The clinical picture of these 66 cases was, in general, similar to that reported from western countries. Although specific infectious diseases were omitted from the group, myocardial inflammation was suggested as a possible cause of the myocardial disease in 7 nonobstructive cases. History as a chronic alcoholic, which has long been neglected in Japan as a cause of cardiomyopathy, was revealed in 6 cases of nonobstructive cardiomyopathy. Their clinical findings suggested a gradually progressing disease of the myocardium, which involved diffusely all cardiac chambers. Predominant right heart involvement was not observed. The gray area between obstructive and nonobstructive cardiomyopathy was discussed and possible inclusion of the former cases in the latter group was suggested.

(Author)

**A71-35121 # Left ventricular time-varying pressure/volume ratio in systole as an index of myocardial inotropism.** Hiroyuki Suga (Tokyo Medical and Dental University, Tokyo, Japan). *Japanese Heart Journal*, vol. 12, Mar. 1971, p. 153-160. 16 refs. Research supported by the Sakkokai Foundation.

The pressure/volume ratio of the left ventricle in systole in a positive inotropic state is compared with a control in experiments with dogs. The results obtained indicate that the maximum value of the ratio in systole is increased and the time course is shortened by positive inotropism (i.e. stimulation of the left stellate ganglion), but that the contour of the time course is virtually unchanged by positive inotropism.

M.V.E.

**A71-35143 Effect of training on plasma enzyme levels in man.** J. Barry Hunter and Jerry B. Critz (Western Ontario, University, London, Ontario, Canada). *Journal of Applied Physiology*, vol. 31, July 1971, p. 20-23. 47 refs. Research supported by the Defence Research Board of Canada.

In a group of healthy young men, the effect of changes in the level of glutamic-oxalacetic transaminase, creatine phosphokinase, and lactic dehydrogenase in plasma is determined. An attempt is made to elucidate some of the effects of changes in fitness on the plasma enzyme response to exercise. It is found that trained skeletal muscle has an increased availability of adenosine triphosphate, which may better maintain the integrity of cell membranes during work and thus reduce enzyme efflux.

M.V.E.

**A71-35144 Cerebrospinal fluid acid-base composition at high altitude.** Søren C. Sørensen and James S. Milledge (California, University, San Francisco, Calif.; Copenhagen, University, Copenhagen, Denmark). *Journal of Applied Physiology*, vol. 31, July 1971, p. 28-30. 22 refs. PHS Grant No. HE-06285.

The purpose of this study was to see if the Andean high-altitude natives who lack a hypoxic peripheral chemoreceptor drive hyperventilate at high altitude because of a low pH in their cerebrospinal fluid (CSF). CSF pH was measured in 16 Andean high-altitude natives living at an altitude of 4300 m (14,500 ft). The mean CSF pH was 7.295 plus or minus 0.001 (SEM); this value is about 0.02 pH units lower than that found in CSF from sea-level natives either at sea level or while sojourning at altitude. The lower CSF pH in the high-altitude natives can explain why they hyperventilate at altitude even though they lack a hypoxic peripheral chemoreceptor drive.

(Author)

**A71-35145 Effect of distension on metabolism of excised dog lung.** Edmund E. Faridy and A. Naimark (Manitoba, University, Winnipeg, Manitoba, Canada). *Journal of Applied Physiology*, vol. 31, July 1971, p. 31-37. 27 refs. Research supported by the Medical Research Council of Canada and the Canadian Tuberculosis and Respiratory Disease Association.

The effect of mechanical deformation (ventilation and static inflation) on metabolism was studied in excised lobes of dog lungs. The lobes were placed in airtight bags, impermeable to gases, and were ventilated with air or kept statically inflated for 3 hrs. It was observed that ventilated lobes consumed significantly more glycogen, lipid, and oxygen than autologous lobes kept statically inflated. The results indicate that mechanical deformation of the lung during ventilation stimulates its metabolic rate and thus contributes to the metabolic cost of ventilation which has heretofore been ascribed exclusively to the activity of respiratory muscles.

M.V.E.

**A71-35146 \* Importance of skin temperature in the regulation of sweating.** Ethan R. Nadel, Robert W. Bullard, and J. A. J. Stolwijk (Yale University, New Haven, Conn.). *Journal of Applied Physiology*, vol. 31, July 1971, p. 80-87. 33 refs. PHS Grants No. GM-45192; No. ES-00123; Contract No. NAS 9-4531.

The major thermal inputs to the thermoregulatory center, internal and skin temperatures, were independently varied to evaluate their interaction and relative contributions toward the regulation of sweating in resting man. Average skin temperature (TS) was modified by rapid application and removal of radiant heat. Sweating rate from the thigh, measured by resistance hygrometry, was found to be directly related to TS during skin heating. Increased internal temperatures were achieved by interposing a brief bout of heavy exercise between heating intervals. The relationship between internal and mean skin temperatures in the control of sweating rate is described by a summation model, where sweating rate is linearly related to internal (esophageal) temperature and the level of TS shifts this relationship in the appropriate direction.

M.V.E.

**A71-35164 Biological and medical cybernetics (Biologicheskaya i meditsinskaya kibernetika).** Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970. 131 p. In Russian.

General principles of control in living organisms, heuristic programming, modeling higher nervous activity, and problems of learning, self-organization, and development of appropriate behavior are considered. Cybernetic problems of physiology are also investigated, in particular, problems connected with the monitoring of human operators, the development of artificial intellect, the use of bioelectric systems to achieve movement control in humans, and problems connected with distance perception and color recognition.

A.B.K.

**A71-35165 # Certain problems of neurobionics (O nekotorykh zadachakh neirobioniki).** S. Ia. Zaslavskii, K. A. Ivanov-Muromskii, and V. Iu. Meitus. In: Biological and medical cybernetics (Biologicheskaya i meditsinskaya kibernetika).

Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 6-13. 35 refs. In Russian.

Outline of the main problems of neurobionics - a branch of bionics dealing with data processing in the brain and the central nervous system. Among the problems considered are the modeling of large ensembles of neurons on computers, the modeling of individual thinking elements (in particular, the modeling of human memory), the production of the technical means of realizing these models, the theory of data processing by the brain with the aid of neuroelectronic systems, the construction of languages to describe processes occurring in living organisms, and the use of electroencephalograms to interpret brain dynamics.

A.B.K.



**A71-35166 #** The problem of modeling distance perception according to the visible brightness of orientators (K voprosu o modelirovanii vospriiataia udalennosti po vidimoi iarkosti orientirov). Ia. Ia. Belik. In: Biological and medical cybernetics (Biologicheskaiia i meditsinskaiia kibernetika). Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 24-28. In Russian.

Consideration of mathematical models of distance perception under flight conditions according to the visible brightness of a luminous surface. A number of models are described which establish the relation between the degree of illumination of the retinal image and the distance of an operator of a moving system from flat orientator wheels emitting light. A.B.K.

**A71-35167 #** Structure and modeling of robots (Struktura i modelirovanie robotov). V. Iu. Meitus. In: Biological and medical cybernetics (Biologicheskaiia i meditsinskaiia kibernetika).

Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 41-50. 8 refs. In Russian.

Consideration of the problem of structurally describing robots and modeling them on computers. Depending on the principles on which the description is based, various algorithms can be used in the algorithmic unit of the robot. Questions related to the formalization of the constraints which the behavior of the robot must satisfy are discussed. The mathematical formulation of these constraints is given in the form of a payoff function. A.B.K.

**A71-35168 #** A new method of monitoring a human operator (Ob odnom metode kontroliia cheloveka-operatora). A. S. Osennii and V. D. Romanov. In: Biological and medical cybernetics (Biologicheskaiia i meditsinskaiia kibernetika).

Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 50-53. 5 refs. In Russian.

Description of a method of objectively monitoring the state of a human operator on the basis of statistical parameters of the electrical activity of the brain. In the new method a statistical analysis is made of the EEG on the basis of numerical characteristics of the energy spectrum, thus making it possible to detect subtle changes in the spectral composition of the EEG. The applicability of the proposed method is demonstrated in the problem of detecting the reactions of an operator to weak specific and nonspecific stimuli. A.B.K.

**A71-35169 #** An adaptive model of a human operator in a pursuit tracking problem (Adaptivnaia model' cheloveka-operatora v odnoi zadache presleduiushchego slezheniia). V. A. Iakubovich and A. V. Timofeev. In: Biological and medical cybernetics (Biologicheskaiia i meditsinskaiia kibernetika).

Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 56-58. In Russian.

Mathematical description of the functioning of an adaptive system modeling the activity of a human operator under conditions of pursuit tracking. The human operator is modeled by a system consisting of input sensors (visual sensors), an adaptive controller (a 'brain'), and an actuating mechanism (a hand mechanism). Particular attention is paid to the problem of synthesizing the 'brain' in accordance with a certain arbitrary 'reasonability' criterion. The proposed model is capable of adapting both to changes in the medium and to changes in the control plant dynamics and the internal parameters of the model itself. The results of analog psychophysiological experiments with a group of operators are cited. A.B.K.

**A71-35170 #** Methodological features of bioelectric control of the movements of the upper extremities in humans (Metodi-

cheskie osobennosti bioelektricheskogo upravleniia dvizheniiami verkhnikh konechnostei cheloveka). L. S. Aleev and V. I. Zborovskii. In: Biological and medical cybernetics (Biologicheskaiia i meditsinskaiia kibernetika). Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 60-63. In Russian.

Summary of experimental data obtained from a study of the possibilities of programmed control of the movements of the upper extremities of humans with the aid of a six-channel bioelectric system. It is shown that with the aid of the proposed system movements can be induced in various flexors and extensors of the wrist and fingers. The possibilities of such a system in the clinical treatment of patients suffering from motor disorders are considered, in particular, the possibility of developing new motor coordinations. A.B.K.

**A71-35171 #** A visual adaptation model and Kries' experiments (Model' adaptatsii zreniia i opyty Kriisa). M. F. Bondarenko and Iu. P. Shabanov-Kushnarenko. In: Biological and medical cybernetics (Biologicheskaiia i meditsinskaiia kibernetika).

Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 64, 65. In Russian.

Verification of a mathematical model of an adaptive signal transformation in the human visual system. The operation of the proposed model is assessed on the basis of the results of Kries' experiments on light adaptation of the visual analyzer, and good agreement between theory and experiment is obtained. A.B.K.

**A71-35172 #** Long-term biological rhythms in the dynamics of human muscular activity (Dlitel'nye biologicheskie ritmy v dinamike myshechnoi rabotosposobnosti cheloveka). I. S. Kucherov, V. G. Tkachuk, A. V. Volkov, N. N. Shabatura, and I. N. Zimin. In: Biological and medical cybernetics (Biologicheskaiia i meditsinskaiia kibernetika).

Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 71-77. 29 refs. In Russian.

Investigation of fluctuations of human muscle power under steady-state conditions of muscular activity. An analysis is made of the variation of the strength of finger flexors by the method of sliding summation and the autocorrelation method. It is found that the variation of muscle strength is of oscillatory nature, but is not strictly periodic. A biological rhythm with a period ranging from 12 to 20 days is detected in the dynamics of muscle capacity. A.B.K.

**A71-35173 #** Models of color data coding and decoding in the human visual organ and in engineering systems (Modeli kodirovaniia i dekodirovaniia informatsii o tsvete v organe zreniia cheloveka i v tekhnicheskikh sistemakh). E. P. Putiatin and V. P. Pchel'nikov. In: Biological and medical cybernetics (Biologicheskaiia i meditsinskaiia kibernetika).

Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 83-86. 7 refs. In Russian.

Consideration of problems connected with the construction of mathematical models of color vision and their use in color recognition devices. A functional study is made of transformations of light emissions in the visual organ and in engineering systems. A model of the recognition of shades of color by humans is proposed, and an engineering analog of this model is developed. A.B.K.

**A71-35174 #** A model of a static transformation of brightness into luminance (Model' staticheskogo preobrazovaniia iarkosti v svetlotu). Iu. P. Shabanov-Kushnarenko and M. F. Bondarenko. In: Biological and medical cybernetics (Biologicheskaiia i meditsinskaiia kibernetika).

Edited by S. D. Koshis. Kiev, Izdatel'stvo Naukova Dumka (Kibernetika i Vychislitel'naia Tekhnika, No. 7), 1970, p. 96-100. In Russian.

Consideration of certain consequences of a previously proposed mathematical model of visual adaptation which suggest the presence of a brightness-to-luminance transformation in the visual organ. These consequences are compared with the results of a psychophysical experiment, and a relation governing a static transformation of brightness into luminance is derived purely logically from these consequences. This relation is shown to have the form of a power function.

A.B.K.

#### A71-35195 # Physiological evaluation of antiexposure suits.

Haruo Ikegami, Takeshi Kimura, Yutaka Mine, and Sueyoshi Tokutome (Japan Air Self-Defense Force, Aeromedical Laboratory, Tachikawa, Japan). *Japan Air Self Defence Force, Aeromedical Laboratory, Reports*, vol. 11, Dec. 1970, p. 155 (1)-159 (5). 5 refs. In Japanese, with abstract in English.

Investigation of the comfortableness of the antiexposure suit KAI-1 in order to assess its optimum environmental temperature. Subjective comfortableness, oral temperature, skin temperature and pulse rate were measured in three subjects wearing this suit for three hr in the climatic chamber. Light cold sensation and some drop in skin temperature were detected, and the optimum environmental temperature is estimated to be slightly above 19 C, probably around 22 C.

M.M.

#### A71-35196 # An experimental study on the learning process with the C-8 trainer.

Hiroko Hagihara, Sadahito Aramaki, Tomohiko Ito, and Yuko Nagasawa (Japan Air Self-Defense Force, Aeromedical Laboratory, Tachikawa, Japan). *Japan Air Self Defence Force, Aeromedical Laboratory, Reports*, vol. 11, Dec. 1970, p. 160 (6)-171 (17). 23 refs. In Japanese, with abstract in English.

Investigation of the basic tendency of the learning process using the C-8 trainer, and of its effective evaluation index. The C-8 trainer was operated 14 times by six inexperienced subjects. The types of flying maneuvers were level, level right and left turns, climb, climbing right and left turns, descent and descending right and left turns. The main findings were: (1) the error ratio decreased day by day while the instrumental error ratio decreased in the right turn, left turn and straight-on sequence; (2) 'numbers of controls' was the most effective evaluation index, compared with amounts of deviated controls calculated from the movement of the elevator, aileron and rudder controls; and (3) the pulse rate was 1.2 to 1.3 times higher than on the ground and was then appreciably high until the second day.

M.M.

#### A71-35197 # The results of physical examination on pilots.

II. Yoshinori Kurihara and Shigeyuki Yagura (Japan Air Self-Defense Force, Aeromedical Laboratory, Tachikawa, Japan). *Japan Air Self Defence Force, Aeromedical Laboratory, Reports*, vol. 11, Dec. 1970, p. 172 (18)-180 (26). In Japanese, with abstract in English.

Derivation of regression equations for some physical functions on age, using the physical examination data of all JASDF pilots in 1968 and 1969. Regression lines were determined on weight, weight-height ratio, Rohrer's index, body surface area, grip strength, systolic, diastolic, and mean blood pressures. Regression curves were determined on near vision and eye accommodation. The investigation showed that the aging effect was greater on eye accommodation and near vision than on other physical functions. It is suggested that the effect of presbyopia should be taken into account in the determination of regression equations in eye accommodation, near vision and distant vision.

M.M.

#### A71-35198 # Study on anthropometry for human engineering. II - Examinations and preparations for anthropometric survey in the fiscal year, 1970.

Yuko Nagasawa and Sadahito Aramaki (Japan Air Self-Defense Force, Aeromedical Laboratory, Tachikawa, Japan). *Japan Air Self Defence Force, Aeromedical Laboratory, Reports*, vol. 11, Dec. 1970, p. 181 (27)-197 (43). 6

refs. In Japanese, with abstract in English.

Investigation of measurement techniques and arrangements used in the 1970 anthropometric survey. The main results obtained are: (1) training for one week was sufficient to accurately find 42 anatomical points in the 1970 report except for the trochanteric and posterior armpit points; (2) the measurement errors of 107 items in the 1970 report were kept at a constant rate by means of one-week training, and many errors were observed in the measurement of body surface; and (3) 100 measuring items were assigned to five skilled measurers who were trained to measure for 1 hr using five subjects.

M.M.

#### A71-35199 # Changes of tracking performance, respiration and heart rate during experimentally induced anxiety.

Suguki Ohhara, Yuuko Nagasawa, Hayao Hori, and Naokazu Hirashima (Japan Air Self-Defense Force, Aeromedical Laboratory, Tachikawa, Japan). *Japan Air Self Defence Force, Aeromedical Laboratory, Reports*, vol. 11, Dec. 1970, p. 198 (44)-205 (51). 7 refs. In Japanese, with abstract in English.

Investigation of changes caused by unexpected noise stress and anticipated psychic stress on tracking performance, respiration and heart rate. The main results obtained are: (1) in general, unexpected noise stress affected performance more strongly than anticipated psychic stress; (2) it took 15 sec to recover from the increased heart rate caused by unexpected stimulation; (3) tracking performance was arrested after 0.4 to 0.8 sec following stimulation; and (4) it took 0.8 to 2.4 sec to recover from this block.

M.M.

#### A71-35209 Information transfer in all-weather operation.

J. M. Naish (McDonnell Douglas Corp., St. Louis, Mo.). *Shell Aviation News*, no. 396, 1971, p. 8-10. 5 refs.

Attempt to broaden the basis for evaluating an aircraft all-weather flight system. The influence of the pilot on overall reliability is considered in terms of the balance of supply and demand in the information process of the complete man-machine system. A more efficient transfer is possible if the man has the same kind of access to information as does the automatic flight control system. Operations of monitoring, decision making, and giving concurrent attention to several matters are improved by reducing the times needed to transfer attention, as is possible with the Head-Up Display (HUD).

F.R.L.

#### A71-35246 # Electrical activity of the cortex and of deep cerebral structures in wakeful Pavie hamadrias (Elektricheskaia aktivnost' kory i glubokikh struktur golovnogo mozga u bo-drstvuiushchikh Pavianov gamadrilov).

A. F. Sysoeva and T. G. Urmancheeva (Akademiia Meditsinskikh Nauk SSSR, Sukhumi, Georgian SSR). *Akademiia Nauk SSSR, Doklady*, vol. 198, May 21, 1971, p. 724-726. 12 refs. In Russian.

Biopotential fluctuations were studied in 94 cortical and 77 subcortical locations in eight Pavie hamadrias apes. The background electrical activity was highly regular in quiet wakeful animals, with insignificant differences at different locations and during slumber. Electrograms are given for biopotentials during orientation reactions and defense reactions and in response to light signals.

V.Z.

#### A71-35247 # Thermal kinetics of the effect of ATP on intact muscular fibers of rats adapted to different temperatures

(Termokinetika deistviia ATF na intaktnye myshechnye volokna krys, adaptirovannykh k raznym temperaturam). V. V. Khaskin and I. N. Sindarovskaia (Akademiia Nauk SSSR, Institut Fiziologii, Novosibirsk, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 198, May 21, 1971, p. 730-733. 15 refs. In Russian.

Attempt to study the adaptation changes in heat production in the muscles of rats kept at 4 to 6 C or at room temperature for six

weeks, by calorimetry of intact muscle fiber suspensions prepared after decapitation. ATP was added to fiber suspensions as a stimulant of heat production. The effects of ATP, ADP and ethylenediamine-tetraacetic acid on heat production are compared. V.Z.

**A71-35250** Recognition time for information stored in long-term memory. J. F. Juola, I. Fischler, C. T. Wood, and R. C. Atkinson (Stanford University, Stanford, Calif.). *Perception and Psychophysics*, vol. 10, July 1971, p. 8-14. 12 refs.

Description of two experiments performed to determine the effects of number of words in a target set (varying from 10 to 26) and the nature of distractor words on the latency of both positive and negative recognition responses. Before the test phase, the subject memorized a list of words and then was tested with a series of single words. To each presentation the subject made a positive or negative response to indicate whether or not the word was a member of the memorized target list. Response latency was observed to be an increasing function of memory list length. Negative response latency also was greater if distractor words were visually or semantically similar to specific target words. The results were analyzed in terms of a modified signal detection model. It is assumed that the subject makes a subjective judgment of the familiarity of a test item and on that basis decides either to respond immediately or to delay the response until a search of the memorized list can be executed. Several different models of the search process are considered and evaluated against latency measures and error data. (Author)

**A71-35251** The effects of stimulus familiarization on patterns of visual selection. Terry T. Faw and James N. Olson (California, University, Los Angeles, Calif.). *Perception and Psychophysics*, vol. 10, July 1971, p. 19-22. 7 refs. Research supported by the University of California.

Study in which patterns of visual selection were recorded as subjects viewed pairs of stimulus drawings in which the two members were either both incongruous or both banal. Prior to presenting the paired stimuli, subject was preexposed to either one member of the stimulus pair or to the incongruous or banal counterpart of one member of the stimulus pair. The results indicate that: (1) preexposure to a stimulus reduced its potential to elicit looking responses, and the magnitude of that reduction was greater for incongruous stimuli than for banal stimuli; (2) preexposure to an incongruous stimulus affected the potential of its banal counterpart to elicit looking responses, but preexposure to a banal stimulus did not affect the potential of its incongruous counterpart to elicit similar responses; and (3) the reduced potential of the preexposed member of a stimulus pair to elicit looking responses waned after 10 sec. These results were discussed in the light of an 'information-conflict resolution' model of visual selection. (Author)

**A71-35252** Perceptual economy and the impression of visual depth. D. Vickers (Adelaide, University, Adelaide, Australia). *Perception and Psychophysics*, vol. 10, July 1971, p. 23-27. 28 refs.

Three experiments were carried out to investigate the hypothesis that the impression of visual depth given by gradient patterns is due to the operation of a principle of 'perceptual economy.' The first experiment showed that the greater the number of values of the gradient variables in a pattern, the stronger was the tridimensional impression given by that pattern. The second showed that the greater the number of gradient variables, the less the amount of the pattern that had to be exposed before a tridimensional response was elicited. The third showed that judged slants increased as a function of the number of gradient variables in each pattern. The results suggest that the impression of visual depth given by a pattern represents a compromise between the economy gained from making a tridimensional specification of the elements in the pattern and the possible cost of making an error in coding the information in this way. (Author)

**A71-35253** Backward masking, disinhibition, and hypothesized neural networks. Daniel N. Robinson (Amherst College, Amherst, Mass.). *Perception and Psychophysics*, vol. 10, July 1971, p. 33-35; Reply, W. R. Uttal, p. 36, 37. 21 refs.

The interpretation by Uttal (1970) is disputed that views the results of some of his experiments as evidence against the notion that lateral inhibition is responsible for a broad range of short-term interference phenomena in vision. It is argued that theoretical expositions seeking to explain phenomena produced by small brief concentric disks of light in the same terms as those necessary to explain effects produced by large displaced complex patterns of light are likely to be wrong. M.V.E.

**A71-35254** Additivity of risk in portfolios. Clyde H. Coombs and James Bowen (Flinders University of South Australia, Bedford Park, Australia). *Perception and Psychophysics*, vol. 10, July 1971, p. 38-42. 13 refs.

The results of experiments are reviewed that were designed to overcome past experimental deficiencies in clarifying the role of accommodation in binocular rivalry control. These results suggest that the peripheral mechanisms of accommodation, pupillary activity, blinking, and retinal image movement, if they have a real effect at all, play only a secondary role in the control of binocular rivalry. M.V.E.

**A71-35255** Variables influencing the mode of processing of complex stimuli. Donna P. Grill (Johns Hopkins University, Baltimore, Md.). *Perception and Psychophysics*, vol. 10, July 1971, p. 51-57. 26 refs.

The present study attempts to specify some of the conditions under which parallel and serial processing may occur. The three variables studied were (1) type of task, (2) relative set for speed vs accuracy, and (3) practice. Pairs of multidimensional, geometric stimuli were presented either simultaneously or successively to S who was required to indicate whether they were the same or different. Each S participated in nine sessions. For half of the Ss speed was emphasized, and for the other half accuracy was emphasized. The results indicated that: (1) responses were faster with successive presentation than with simultaneous presentation; (2) with successive presentation, processing was serial; (3) in the simultaneous presentation condition, a gradual shift from serial to parallel processing occurred with practice; and (4) the speed and accuracy instructions used in this experiment produced no differential effects on latency or errors. (Author)

**A71-35256** Differential luminance sensitivity of the human visual system. J. M. Thijssen and A. J. H. Vendrik (Nijmegen, Katholieke Universiteit, Nijmegen, Netherlands). *Perception and Psychophysics*, vol. 10, July 1971, p. 58-64. 37 refs.

The differential sensitivity of the visual system is investigated by means of two simultaneously presented stimuli in a yes-no procedure. The sensitivity measure appears to be proportional to stimulus intensity. An increment threshold experiment using only one stimulus yields a proportionality of the sensitivity measure with the square root of the background intensity. An additional experiment shows that the sensitivity measure for two flashes decreases first, from dark up to a particular background intensity, and increases when the background tends to mask the flashes. The results cannot easily be explained by the quantum fluctuation concept. A model is proposed that embodies electrophysiological data and encounters a particular adaptation mechanism. M.V.E.

**A71-35325** A model of threshold detection performance for the central fovea. I. Overington and E. P. Lavin (British Aircraft Corp., Guided Weapons Div., Bristol, England). *Optica Acta*, vol. 18,

May 1971, p. 341-357. 25 refs. Research supported by the Ministry of Technology.

Development of a theory of foveal vision based on available knowledge of the physical structure of the human eye, on the one hand, and on certain assumptions, on the other. The product of this theory is an equation that makes it possible to predict threshold detection values for specific target stimuli. Good agreement is achieved with data obtained from a number of various threshold experiments. M.V.E.

**A71-35326** The circadian rhythm of brain acetylcholine levels and motor activity in the rat. Yoshiro Saito (Hokkaido University, Sapporo, Japan). *Life Sciences, Part 1 - Physiology and Pharmacology*, vol. 10, July 1, 1971, p. 735-744. 24 refs. Research supported by the Ministry of Education.

A circadian variation has been demonstrated in both 'free' and 'bound' acetylcholine content in rat brains by the chemical assay of Fellman. The near-freezing method of Takahashi et al. was employed in obtaining brain samples for analysis. Both 'free' and 'bound' ACh values showed a peak at 6 hours in the light and low levels throughout the dark period. This pattern is compatible with the daily cycle of motor activity of rats, which exhibited an increase in the dark phase, and a reduction during the light period when the animals are apparently asleep. A hypothesis is presented that the metabolism of brain ACh is closely correlated with spontaneous motor activity and the sleep-awake mechanism. (Author)

**A71-35357** Physiology of higher nervous activity. Part 1 - Basic laws and mechanisms of conditioned reflex activity (Fiziologiya vysshei nervnoi deiatel'nosti. Part 1 - Osnovnye zakonomernosti i mekhanizmy uslovnoreflektornoi deiatel'nosti). Edited by E. A. Asratian. Moscow, Izdatel'stvo Nauka, 1970. 632 p. 1976 refs. In Russian.

The subjects include inhibition, direct and reverse conditioned connections, structural and functional aspects of conditioned reflex activation, and specific types of conditioned reflexes. Bioelectrical effects associated with conditioned reflexes, the concept of a dominant, and the phylogenesis and ontogenesis of higher nervous activity are also covered. An extensive bibliography and author and subject indexes are provided.

V.Z.

**A71-35358 #** Structural organization of locking activity of the brain (O strukturnoi organizatsii zamykatel'noi deiatel'nosti mozga). O. S. Adrianov. In: Physiology of higher nervous activity. Part 1 - Basic laws and mechanisms of conditioned reflex activity (Fiziologiya vysshei nervnoi deiatel'nosti. Part 1 - Osnovnye zakonomernosti i mekhanizmy uslovnoreflektornoi deiatel'nosti).

Edited by E. A. Asratian. Moscow, Izdatel'stvo Nauka, 1970, p. 40-74. In Russian.

Current views concerning the location of cerebral processes which control contact mechanisms activating conditioned reflexes are discussed. The topics include the structure of the stimulus analyzer, the role of the unconditioned stimulus analyzer in conditioned reflex activity, the role of horizontal linking systems in integrated cerebral activity, and the structural organization of functional mechanisms controlling the relations between the cortex and subcortex. Contradictions and disagreement that exist in present views on the subject are indicated. V.Z.

**A71-35359 #** Inhibition in higher nervous activity (Tormozhenie v vysshei nervnoi deiatel'nosti). E. A. Asratian. In: Physiology of higher nervous activity. Part 1 - Basic laws and mechanisms of conditioned reflex activity (Fiziologiya vysshei nervnoi deiatel'nosti. Part 1 - Osnovnye zakonomernosti i

mekhanizmy uslovnoreflektornoi deiatel'nosti).

Edited by E. A. Asratian. Moscow, Izdatel'stvo Nauka, 1970, p. 75-134. In Russian.

Consideration of theories concerning the inhibition mechanisms active in the cerebrum. Induction inhibition, protective inhibition, and conditioned inhibition are discussed. Also covered are the electrophysiological indices of inhibition of higher nervous activity, the Pavlovian views on the mechanisms and localization of individual cortical inhibition types, and other current theories on the subject. V.Z.

**A71-35360 #** Direct and reverse conditioned connections (Priamye i obratnye uslovnye svyazi). M. I. Struchkov. In: Physiology of higher nervous activity. Part 1 - Basic laws and mechanisms of conditioned reflex activity (Fiziologiya vysshei nervnoi deiatel'nosti. Part 1 - Osnovnye zakonomernosti i mekhanizmy uslovnoreflektornoi deiatel'nosti). Edited by E. A. Asratian. Moscow, Izdatel'stvo Nauka, 1970, p. 135-168. In Russian.

Review of Soviet and foreign studies on conditioned reflexes with special attention to studies by Pavlov and his school. Reverse connections in conditioned alimentary and defense reflexes, the formation of reverse connections in response to combinations of indifferent stimuli, reverse conditioned reflexes in man, electrophysiological manifestations of direct and reverse conditioned connections, and the occurrence of such connections in response to a pair of unconditioned reflexes are discussed. V.Z.

**A71-35361 #** Neuronal mechanisms of the orientation reflex (Neironal'nye mekhanizmy orientirovochnogo refleksa). E. N. Sokolov. In: Physiology of higher nervous activity. Part 1 - Basic laws and mechanisms of conditioned reflex activity (Fiziologiya vysshei nervnoi deiatel'nosti. Part 1 - Osnovnye zakonomernosti i mekhanizmy uslovnoreflektornoi deiatel'nosti). Edited by E. A. Asratian. Moscow, Izdatel'stvo Nauka, 1970, p. 238-267. In Russian.

Discussion of the activity of neurons in the development of orientation reflexes in humans and animals under the action of various stimuli and their combinations. Particular attention is given to the extinction of reactions to sound and light in neurons of the hippocampus. Changes in the functional state following the extinction of the orientation reflex are also considered. V.Z.

**A71-35362 #** Bioelectrical manifestations of conditioned reflex activity and their functional meaning (Bioelektricheskie proiavleniya uslovnoreflektornoi deiatel'nosti i ikh funktsional'naiia znachimost'). I. N. Knipst. In: Physiology of higher nervous activity. Part 1 - Basic laws and mechanisms of conditioned reflex activity (Fiziologiya vysshei nervnoi deiatel'nosti. Part 1 - Osnovnye zakonomernosti i mekhanizmy uslovnoreflektornoi deiatel'nosti).

Edited by E. A. Asratian. Moscow, Izdatel'stvo Nauka, 1970, p. 294-355. In Russian.

Review of the bioelectrical aspects of conditioned reflexes in the light of Soviet and foreign studies. The topics include the changes occurring in the frequency-amplitude characteristics of cortex background biopotentials and changes in the alpha-rhythm depression reaction and in the cortical and cerebral biopotentials during the development of conditioned reflexes. Also covered are supraslow biopotential fluctuations during the development of temporal connections, the behavior of biopotentials during the development of conditioned reflexes to rhythmic stimuli, distant cerebral biopotential synchronization and its effects on the development of temporal connections, and changes in the activity of individual cortical and subcortical neurons during the development of temporal connections. V.Z.

**A71-35363 #** The dominant (Dominanta). V. S. Rusinov. In: Physiology of higher nervous activity. Part 1 - Basic laws and

mechanisms of conditioned reflex activity (Fiziologiya vysshei nervnoi deiatel'nosti. Part 1 - Osnovnye zakonomernosti i mekhanizmy uslovnorefleksnoi deiatel'nosti). Edited by E. A. Asratian. Moscow, Izdatel'stvo Nauka, 1970, p. 356-429. In Russian.

Discussion of the dominant - a term and concept introduced in 1911 by Ukhtomskii to denote a reflex which is dominant in the organism of an animal at each moment of its activity, or a temporarily dominating reflex system which directs the work of nervous centers at a given moment. The topics include the history of this concept, the transformation of stimulation focuses into a dominant, a cortical dominant model generated by a weak dc, and the trace effects of a dominant and memory. Also covered are the diffusion effects in the central nervous system, the relations between the cortex and subcortex under a dominant, stimulation focuses due to rhythmic stimuli, correlation analysis data, and lasting electrical potentials in the cortex and their functional meaning. V.Z.

**A71-35364 # Physicochemical basis of conditioned reflex activity (Fiziko-khimicheskie osnovy uslovnorefleksnoi deiatel'nosti).** A. B. Kogan. In: Physiology of higher nervous activity. Part 1 - Basic laws and mechanisms of conditioned reflex activity (Fiziologiya vysshei nervnoi deiatel'nosti. Part 1 - Osnovnye zakonomernosti i mekhanizmy uslovnorefleksnoi deiatel'nosti).

Edited by E. A. Asratian. Moscow, Izdatel'stvo Nauka, 1970, p. 430-472. In Russian.

The physicochemical aspects of conditioned reflexes are discussed on the basis of published studies. The topics include the membrane mechanism of reflex activation, the dynamics of sub-cellular structures, the reverberative mechanisms of conditioned reflexes, and the effectiveness of synapses. Details are also given on mediation processes, on the chemical nature of conditioned reflex consolidation and on the role of ribonucleotides in the formation and variability of conditioned connections. The possible organization of physicochemical processes on the cellular and system levels during conditioned reflex activity is also considered. V.Z.

**A71-35365 # Specific features in the conditioned reflex activity of man (Osobennosti uslovnorefleksnoi deiatel'nosti cheloveka).** M. M. Kol'tsova and N. I. Kasatkin. In: Physiology of higher nervous activity. Part 1 - Basic laws and mechanisms of conditioned reflex activity (Fiziologiya vysshei nervnoi deiatel'nosti. Part 1 - Osnovnye zakonomernosti i mekhanizmy uslovnorefleksnoi deiatel'nosti).

Edited by E. A. Asratian. Moscow, Izdatel'stvo Nauka, 1970, p. 540-570. In Russian.

The gradually increasing sophistication of conditioned reflexes in human infants and children is discussed to demonstrate the gradual development of interrelations between individual systems of signals in man. Particular attention is given to Sechenov's views on the development of generalizing functions in children up to 5 years old in response to spoken words. V.Z.

**A71-35366 Lactic acid production in supramaximal exercise.** R. Margaria, P. Aghemo, and G. Sassi (Milano, Università, Milan, Italy). *Pflügers Archiv*, vol. 326, no. 2, 1971, p. 152-161. 10 refs. Research supported by the Consiglio Nazionale delle Ricerche.

Determination of the rate of appearance of lactic acid in the blood in 12 subjects of different muscular fitness performing the same supramaximal exercise. The maximum performance time and the maximum lactic acid concentration in the blood are also determined. The rate of increase of lactic acid is higher in the less fit than in the athletic subjects, to compensate for the lower oxygen consumption. In all subjects the appearance of lactic acid in the blood is delayed: at the onset of the exercise other anaerobic processes (alactic) supply the energy required, and only when these are exhausted does lactic acid formation enter into play. The energy due to lactic acid corresponds to 37 plus or minus 3.5 ml of O<sub>2</sub> per g

of lactic acid increase in 1 liter of blood, or 50 ml of O<sub>2</sub> (or 250 cal) per gram of lactic acid produced from glycogen. The maximum amount of the lactic acid debt is equivalent to about the maximum oxygen consumption in 1 min. A simple relation is found between the time of performance in supramaximal exercise and the maximum oxygen consumption. (Author)

**A71-35367 Sympathetic nervous response to induced fall and rise of arterial blood pressure in anesthetized rabbits.** H. Aars and S. Akre (Oslo, University; Ullevål Hospital, Oslo, Norway). *Pflügers Archiv*, vol. 326, no. 3, 1971, p. 223-230. 27 refs. Research supported by the J. L. Tiedemanns Tobaksfabrik, the J. H. Andersens Medical Fund, and the Norwegian Council on Cardiovascular Diseases.

To investigate the effect of the baroreceptor reflex on the rise and fall in arterial blood pressure, the relationship between blood pressure/aortic nerve activity and efferent sympathetic activity in renal and splanchnic nerves was experimentally examined. The results seem to confirm the assumption that the baroreceptor reflex strongly counteracts a rise in arterial blood pressure above control levels; however, withdrawal of baroreceptor activity during the first few minutes after a pressure reduction does not increase sympathetic activity. O.H.

**A71-35368 On the mechanisms of the hypoxia-induced increase of 2,3-diphosphoglycerate in erythrocytes.** J. Duhm and E. Gerlach (Rheinisch-Westfälische Technische Hochschule, Aachen, West Germany). *Pflügers Archiv*, vol. 326, no. 3, 1971, p. 254-269. 40 refs. Deutsche Forschungsgemeinschaft Grant No. Ge 129/8.

The effects of hypoxia, hypercapnia, anemia and polycythemia on red cell 2,3-diphosphoglycerate (DPG) levels were studied in rats in vivo. Furthermore, the influence of the oxygenation state of hemoglobin on the rates of synthesis and decomposition of 2,3-DPG in human blood cells was investigated in vitro. The results provide evidence that two factors are of particular importance as regulatory mechanisms with respect to the increase of 2,3-DPG during oxygen deficiency: changes in the blood pH, and changes in the oxygenation state of hemoglobin. The significance of these regulatory mechanisms in inducing and limiting the changes of red cell 2,3-DPG during hypoxia and anemia are discussed. O.H.

**A71-35388 \* Thermoregulatory set point during exercise - A behavioral approach.** M. Cabanac, D. J. Cunningham, and J. A. J. Stolwijk (Yale University, New Haven, Conn.). *Journal of Comparative and Physiological Psychology*, vol. 76, July 1971, p. 94-102. 27 refs. Contract No. NAS 9-9531.

Response to a peripheral thermal stimulus has been shown to be an indicator of thermal status with respect to the thermoregulatory set point. The subjects were provided with a glove perfused with water, adjustable in temperature between 15 and 45 C. The subjects were asked to maintain the glove temperature at the level they considered most pleasant. In response to environmental temperatures ranging 15-45 C and to exercise at levels of 500 and 1000 kgm/min, the selected glove temperature ranged 20-40 C. The preferred glove temperature depended strongly on internal body temperature; it was affected to a lesser extent by mean skin temperature and not at all by exercise alone. The results suggest there is no change in thermoregulatory set point during exercise. (Author)

**A71-35392 Development of an eye movement stimulator and monitor.** M. V. Srinivasan and B. L. Deekshatulu (Indian Institute of Science, Bangalore, India). *Indian Journal of Pure and Applied Physics*, vol. 9, Apr. 1971, p. 253-260. 9 refs.

Summary of design considerations for the development of a conjugate eye movement stimulator and monitor. The apparatus is

designed for experimentation on a human subject, and is equipped with facilities for experimental investigation in the closed-loop, open-loop, and variable feedback modes of operation. The stimulus consists of a target position on a screen, the target being confined to move in a horizontal plane and at a constant distance from the subject. Such an arrangement evokes eye movement responses that are purely conjugate in character. The eye position (while tracking the target) constitutes the response and is monitored by photoelectric means. The stimulus-response records of some experimental closed-loop runs, which indicate the discrete-time nature of the biological tracking servomechanism, are included. (Author)

**A71-35433**      **Distributive reaction times in single and multiple response units.** F. S. Morgerstern, S. H. Haskell (London, University, London, England), and P. D. Waters. *Ergonomics*, vol. 14, Mar. 1971, p. 219-230. 27 refs.

The concern of these experiments was with the properties of response units to a simple stimulus, presented in the visual or auditory mode. It was found that the RT for a given letter is affected by the organization of the response unit by its position and by the size of the response unit. The RT's for all items in response units were affected by the modality; RT's to visually presented stimuli were slower at all positions in the response units. The frequency of errors in the auditory series was almost twice that of the visual series. There was no consistent carry over of practice with one response unit to another made up of a smaller or larger number of items. In each facet of the investigation, therefore, there was a strong indication that there is a higher-order of motor response integration in which a number of responses become organized into units which have characteristics of their own. (Author)

**A71-35434**      **Human power output in exercise of short duration in relation to body size and composition.** C. T. M. Davies (Medical Research Council, Environmental Physiology Unit, London, England). *Ergonomics*, vol. 14, Mar. 1971, p. 245-256. 17 refs.

Maximum power output during the performance of a standing jump of two feet from a force platform and stair climbing has been studied in 47 male subjects aged from 20 to 50 years and 8 female subjects aged from 18 to 27 years in relation to body composition. During the standing jump, power output mean values of 5.23 hp for men and 3.15 hp for women were recorded. These figures are among the highest ever recorded in man; they are some four times higher than the corresponding values for the stair climb and fifteen times those achieved during maximum aerobic work on a stationary bicycle ergometer. Maximum power output in the two forms of activity were dependent on age and sex. G.R.

**A71-35435**      **The aerobic and anaerobic components of work during submaximal exercise on a bicycle ergometer.** C. T. M. Davies and J. Musgrove (Medical Research Council, Environmental Physiology Research Unit, London, England). *Ergonomics*, vol. 14, Mar. 1971, p. 257-263. 21 refs.

Investigation of intersubject variability of oxygen intake in relation to the anaerobic component of work intensively on two healthy subjects and extensively on two groups of young and older men during work on an upright, stationary bicycle ergometer. Significant differences ( $p$  less than 0.001) in oxygen intake were shown to exist between the two groups of subjects and the healthy men at the higher work loads which could not be eliminated entirely by correction for body weight. The residual variation of oxygen intake on work load was shown to be a consequence of the variation of the anaerobic component of exercise. During work on a bicycle ergometer at exercise above about 50% maximum oxygen intake this should be taken into account if a valid assessment of energy expenditure is to be made. (Author)

**A71-35436**      **Violent exercise and a cognitive task.** M. Hammerton (Medical Research Council, Applied Psychology Unit, Cambridge, England). *Ergonomics*, vol. 14, Mar. 1971, p. 265-267.

An investigation was conducted into the effect of a burst of violent exercise upon a cognitive task. No decrement was detected; and it was concluded that mild hypoxia did not account for decrements in skills previously found. (Author)

**A71-35437**      **Movements with lateral constraint.** C. G. Drury (Birmingham, University, Birmingham, England). *Ergonomics*, vol. 14, Mar. 1971, p. 293-305. 12 refs.

A model is considered for tasks where the subject must guide a vehicle at his own speed along a course defined by a tolerance band. The model predicts a linear relationship between the average velocity and the width of the tolerance band. Three experiments are described which simulate vehicle guidance by pencil-and-paper experiments for courses consisting of straight lines and circles. The predictions of the model were confirmed, suggesting that a general measure for the ease of control of a vehicle is possible using this technique. G.R.

**A71-35438 #**      **Exobiology in astronautics (Egzobiologia w astronautyce).** Zbigniew Jethon. *Technika Lotnicza i Astronautyczna*, vol. 26, June 1971, p. 4-7. In Polish.

Survey of research on the possibilities, conditions, and forms of extraterrestrial life. Upper and lower tolerance limits are tabulated for microorganisms and some higher life forms with respect to excesses in temperature, electrostatic field, pH, hydrostatic pressure, mineral salts, atmospheric pressure, and partial oxygen pressure. Environmental conditions on planets of the solar system are outlined, and automatic probe missions designed to detect the presence of life are considered. T.M.

**A71-35449**      **Neutron radiography and dosimetry in human beings - Theoretical studies.** T. F. Budinger (California, University, Berkeley, Calif.), R. J. Howerton, and E. F. Plechaty (California, University, Livermore, Calif.). *Physics in Medicine and Biology*, vol. 16, July 1971, p. 439-450. 21 refs. Research supported by the University of California and AEC.

Calculation of neutrons of 1 keV, 120 keV, fission spectrum, and 14 MeV, incident on a simulated human arm, to analyze the dose distributed to bone and marrow, and to determine the feasibility of neutron radiography as a practical clinical tool. The resolution possible through tissues as thick as 6 cm makes neutron radiography impractical except for very special circumstances. The dose calculations reveal as much as a twofold increase in dose deposited in the bone cortex compared with surrounding contiguous tissues. The skin dose is approximately twice the dose 3 cm inside the tissue. The average absorbed dose in the arm on the basis of a fluence of 10 to the 10th neutrons incident per sq cm is 0.5, 1.6, 10, and 40.4 rads for 1-keV, 120-keV, fission-spectrum, and 14-MeV neutrons, respectively. (Author)

**A71-35450**      **Measurement of skin dose from low energy beta and gamma radiation using thermoluminescent discs.** M. Marshall and J. Docherty (Atomic Energy Research Establishment, Harwell, Berks., England). *Physics in Medicine and Biology*, vol. 16, July 1971, p. 503-510. 11 refs.

A thermoluminescent dosimeter is described, designed to directly measure the dose to the basal layer from beta-rays with maximum energy greater than 0.15 MeV. It utilizes thin disks of Teflon loaded with lithium fluoride which provide a convenient measure of the beta-ray dose. The response to photons is independent of energy above 80 keV with an increase in sensitivity to about

1.55 around 30 keV. The dosimeter can be used in mixed beta-ray and gamma-ray fields to measure the dose to an accuracy greater than that normally required for health physics purposes. O.H.

**A71-35486 # Hazards of electrocution and safety precautions in the use of electrical medical apparatus employing electrodes and intracardiac catheters (Pericoli di folgorazione e misure di sicurezza inerenti all'uso di apparecchi elettromedicali che utilizzano elettrodi e cateteri intracardiaci).** *Alta Frequenza, Supplemento*, vol. 40, May 1971, p. 118s-127s. 5 refs. In Italian.

The danger threshold of electric current for patients whose heart is electrically connected with the outside through the catheter of an electrical medical device reaches very low values down to a few microamperes. The hazards represented by the electrical system to a patient are examined, and measures necessary to achieve an acceptable degree of safety are indicated, together with precautions that should be adopted by the medical staff. M.M.

**A71-35489 # Photoc and electric release of afterdischarges in the visual cortex of rats before and after disconnections in the visual system (Photisch und elektrisch ausgelöste Nachentladungen im visuellen Kortex der Ratte vor und nach Ausschaltungen im visuellen System).** M. Kohler and F. Klingberg (Leipzig, Universität, Leipzig, East Germany). *Acta Biologica et Medica Germanica*, vol. 26, no. 4, 1971, p. 697-710. 55 refs. In German.

The importance of the retina and Corpus geniculatum laterale (CGL) in the release of photic afterdischarges in the visual cortex was investigated on freely moving rats with chronically imbedded bipolar electrodes in the CGL and over the visual cortex, frontal cortex, and olfactory bulb. Afterdischarges were elicited either by light flashes or by electrical stimulation of the CGL. Subsequently, the effect of enucleation of one or both eyes, of coagulation of one or both CGL, or the combination of both interventions on the release of afterdischarges were studied. The obtained results include the finding that electrical stimulation of one CGL causes synchronous afterdischarges in both visual cortices, as long as the other CGL is intact, and show that the key mechanism for the generation of photic afterdischarges is localized in the CGL. M.V.E.

**A71-35490 # 'Desensitization' of cholinergic receptors in the retina ('Desensitization' cholinergischer Rezeptoren der Netzhaut).** P. Dettmar (Leipzig, Universität, Leipzig, East Germany). *Acta Biologica et Medica Germanica*, vol. 26, no. 4, 1971, p. 771-777. 36 refs. In German.

Study of the fundamental nature of the effects of ACh application to the retina under varying conditions. In the light of a number of experimental findings, it is shown that these effects can be interpreted as a result of what is called the 'desensitization' of the cholinergic receptors of the second retinal neuron. M.V.E.

**A71-35499 \* Stimulus control during conditional discrimination.** Matthew Yarczower (Bryn Mawr College, Bryn Mawr, Pa.). *Journal of the Experimental Analysis of Behavior*, vol. 16, July 1971, p. 89-94. 8 refs. Grant No. NGR-39-018-002.

Generalization tests conducted with pigeons after each of three stages of comparable training have yielded results that make possible an analysis of conditional stimulus control. Two visual dimensions and a single-key situation were used. The results obtained may help in the assessment of the nature of behavioral control by one dimension in the absence of stimuli used in the training of the conditional discrimination. M.V.E.

**A71-35574 \* Ribosome-catalyzed polyester formation.** Stephen Fahnestock and Alexander Rich (MIT, Cambridge, Mass.).

*Science*, vol. 173, July 23, 1971, p. 340-343. 11 refs. NIH-NSF-NASA-supported research.

Deamination of phenylalanyl-transfer RNA with nitrous acid yields the alpha-hydroxyacyl analog, phenyllactyl-transfer RNA. When this is incubated in a protein-synthesizing system directed by polyuridylic acid, it yields an acid-precipitable, alkali-labile polyester of phenyllactic acid. M.V.E.

**A71-35575 \* Human auditory attention - A central or peripheral process.** Terence W. Picton, Steven A. Hillyard, Robert Galambos, and Maurice Schiff (California, University, La Jolla, Calif.). *Science*, vol. 173, July 23, 1971, p. 351-353. 23 refs. Grant No. NGR-05-009-008.

The click-evoked electrical responses of the human cochlear nerve were recorded from the external ear canal concurrently with the cortical evoked potentials from the scalp. Paying attention to the clicks during a discrimination task resulted in a highly significant enhancement of the cortical response but no change in the cochlear nerve response. Hence no evidence was obtained for the operation of a peripheral gating mechanism during attention in man. (Author)

**A71-35586 # Quantitative reconstruction and superresolution of red-blood-cell image holograms.** Evan A. Evans (California, University, La Jolla, Calif.). *Optical Society of America, Journal*, vol. 61, Aug. 1971, p. 991-997. 27 refs. NIH Grant No. HE-12494-02; NSF Grant No. GK-10553; Grant No. AF AFOSR 1186-67c.

A quantitative method for reconstruction and superresolution of red-blood-cell image holograms (interferograms) is described, with resolution improvement to 4% of the wavelength; the approach is based on the principles of coherent physical optics and is automated in the form of computer programs. The red-blood-cell phase information is reconstructed from the hologram; then the phase-distribution resolution is improved using symmetry, surface-continuous differentiability, and space-limited conditions. (Author)

**A71-35616 # A model of a bioelastic body (Model' biouprugogo tela).** L. V. Nikitin. *Akademiia Nauk SSSR, Izvestiia, Mekhanika Tverdogo Tela*, May-June 1971, p. 154-157. In Russian.

Development of a model of muscle contraction under the action of biological factors. It is shown that if the stresses or strains in the muscle fibers can be measured it is possible to determine the dependence of the biological factor on the intensity of the stimulating signals. The proposed model is applied to a study of the equilibrium of a circular cylindrical vessel acted upon by an internal pressure, an external pressure, and a biological factor. The internal lumen of the vessel established during the action of the pressure and the biofactor is determined. A.B.K.

**A71-35641 # Flow of a viscous liquid in a porous tube with a deforming wall (Tечение вязкой жидкости в пористой трубке с деформирующей стенкой).** S. A. Regirer and I. M. Skobeleva (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza*, May-June 1971, p. 118-131. 9 refs. In Russian.

Investigation of the quasi-stationary flow of a viscous incompressible liquid in a tube with deformable and slightly permeable walls. Emphasis is placed on peristaltic flows where the motion of the liquid is caused primarily by changes of the channel radius. The approximate method of solving the problem involves reduction of the order of the initial system of equations under simplifying restrictions imposed on the wall contraction rate, the wall filtration rate, pressure gradients, and axial velocity of the flow. Numerical results are given for the effects of (1) wall permeability on the main flow, and (2) wall deformation on flow through the wall. T.M.

**A71-35739** Is autokinetic motion related to experienced displacement. Joseph Glick (Minnesota, University, Minneapolis, Minn.). *American Journal of Psychology*, vol. 84, June 1971, p. 210-217. 10 refs. NIH Grant No. HD-03947.

Apparent visual movement and apparent displacement of a luminous target, under conditions used by Gregory and Zangwill (1963) for producing autokinetic motion, were investigated in one experiment, and changes in egocentric localization (apparent displacement) were measured by nonvisual means under the same conditions in a second experiment. In the first experiment, motion and displacement measures were indeed related. The results of the second experiment further suggested that the relationship holds beyond the purely visual sphere. M.V.E.

**A71-35792** Psychological correlates of a model of the human visual system. Arthur P. Ginsburg (USAF, Institute of Technology, Wright-Patterson AFB, Ohio). In: NAECON '71; Institute of Electrical and Electronics Engineers, National Aerospace Electronics Conference, Dayton, Ohio, May 17-19, 1971, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 283-290. 23 refs.

A priori hypotheses concerning psychological correlates of pattern-identification perception tasks and invariance of pattern recognition under rotation have been investigated with the Kabrisky model of the human visual system embodied by the Tallman-Radoy computer algorithm with significant results. Gestalt principles of similarity, proximity, closure, and figure-ground perception as well as geometric illusions are explained in terms of spatial-filter bandwidth. The experimental results have allowed postulates which extend the Kabrisky model by means of the less densely connected Mahaffey transform and also a spatial-filter shape that is psychologically correlated. It is further postulated that the human perceptual space is the image domain from spatially filtered transforms of object forms. Experimental results support the validity of the Kabrisky model and the Tallman-Radoy algorithm as a means of obtaining quantitative psychological correlates of the human visual system. Suggestions are made for additional psychological correlates. (Author)

**A71-35793** Recent developments in pattern recognition using spatial filtering. R. A. Gill (USAF, Institute of Technology, Wright-Patterson AFB, Ohio). In: NAECON '71; Institute of Electrical and Electronics Engineers, National Aerospace Electronics Conference, Dayton, Ohio, May 17-19, 1971, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 291-297. 16 refs.

A description of recent developments in a pattern recognition system, modeled on the human visual system, is presented. These developments are considered in three main categories: developments relating to the biological model, to extending the scope of the model, and to applications of the model. The second part of the paper describes in detail one modification to the model which allows for considerable scale changes in the input stimuli. This modification is based on the scaling property of Fourier transforms as applied to the discrete case. A definition for scale is presented and shown to relate to the human concept of size. The modified system is tested on a non-trivial recognition problem and the results clearly demonstrate the need for a scaling algorithm and its effectiveness. (Author)

**A71-35801** The structure and function of extraocular muscle - An appraisal of the duality concept. Goodwin M. Breinin (New York University, New York, N.Y.). *American Journal of Ophthalmology*, vol. 72, July 1971, p. 1-9. 35 refs. NIH Grants No. EY-00191-13; No. EY-00309-05.

The structure and function of extraocular muscle are analyzed from the standpoint of the duality concept, which defines a slow and a fast motor system based on slow and fast muscle fibers. The anatomical characteristics of the slow and fast motor system,

including muscle and nerve, are reviewed with respect to light and electron microscopic structure. The pharmacology and physiology of extraocular muscle are reviewed with respect to the special properties of the slow and fast muscle fibers and their innervation. The role of the slow and fast motor system in the electromyogram (EMG) is considered, together with bioengineering aspects of ocular movement in terms of the slow and fast motor systems. It is concluded that there is insufficient evidence to ascribe specific functions to specific muscle fibers. It is probable that eye movements are based on coordinated and integrated action of both slow and fast motor systems. M.M.

**A71-35802** Rhythmic wavelets of the positive off effect in the human electroretinogram. Yutaka Tsuchida, Jerry H. Jacobson (Cornell University, New York, N.Y.), and Kazuo Kawasaki (Kanazawa University, Kanazawa, Japan). *American Journal of Ophthalmology*, vol. 72, July 1971, p. 60-69. 25 refs. Research supported by the Samuel Bronfman Foundation; NIH Grant No. EY-00264.

Demonstration of the manner in which multiple off effects in the electroretinogram (ERG) of man are easily recorded, using intense stimuli, an averaging computer, and a short-time constant amplifier. Intense stimuli of 740 msec duration evoked a sequence of fast rhythmic wavelets superimposed on the positive off effect. These off wavelets were observed in all normal subjects tested, and their shape, inverted, resembled that of the oscillatory potentials superimposed on the b-wave. Close similarity exists in amplitude and latency from stimulus off and on, respectively, between the troughs of the off wavelets and the peaks of the oscillatory potentials. Studies of several pathologic cases indicated gross parallelism in effects on the off wavelets and on the oscillatory potentials in the diseases in question. M.M.

**A71-35803** Meniscus-induced thinning of tear films. James E. McDonald and Stephen Brubaker (Illinois, University, Chicago, Ill.). *American Journal of Ophthalmology*, vol. 72, July 1971, p. 139-146. 10 refs. Research supported by the Illinois Society for the Prevention of Blindness; PHS Grant No. 5-T1-NBO 5191-12.

Description of some in vitro phenomena of fluid films in the region of the menisci, and demonstration of clinical examples of these in the tear films of normal and diseased eyes. There is a thinning of fluid films adjacent to concave menisci both in vitro and in the tear film. Films fracture preferentially in these thin areas. Menisci of the eyelids, of contact lens, of bubbles and mucus or debris in the tear film, or of adjacent perilimbal elevations such as filtering blebs, all have an adjacent area of thinning where film fracture and resultant staining often occur. It is pointed out that this sucking action of the eyelid menisci seems to be a basic mechanism for subsurface tear removal. M.M.

**A71-35829** New theory about the velocity transposition phenomenon (Eine neue Theorie zum Geschwindigkeitstranspositionsphänomen). Klaus-Martin Goeters (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugmedizin, Hamburg, West Germany). *Psychologische Forschung*, vol. 34, 1971, p. 253-282. 12 refs. In German. (DFVLR-SONDDR-107)

Two existing theories concerning the velocity transposition phenomenon are discussed: the theory of the analogy between physical and subjective velocity and the theory of frequency matching. It is shown that both theories are not able to explain the velocity transposition completely. A new theory is introduced which is based on constancy effects in the perception of velocity. This theory gives an explanation for those velocity transposition effects which have not been understood up to now. Moreover four experiments are described which clearly demonstrate that the velocity transposition phenomenon is not produced by frequency



matching. On the other hand the experimental results are not contrary to the new theory of constancy. At last the importance of this theory for human engineering guidance in the field of sea, land, air and space traffic is discussed beside its value for the cinematographer. (Author)

**A71-35849** An accommodometer - An apparatus for measuring the total accommodation response of the human eye. G. J. van der Wildt and M. A. Bouman (Royal Dutch Eye Hospital, Utrecht, Netherlands). *Applied Optics*, vol. 10, Aug. 1971, p. 1950-1958. 16 refs.

An apparatus is described that measures automatically the response of the eye to an accommodation stimulus. It enables one to record the change of the lens power, of the pupil size, and of the eye position simultaneously from one eye without impeding that eye from performing its normal visual tasks. The measuring technique is based on the properties of the light beam coming out of the eye from an ir light spot that is projected on the retina. The outgoing beam is split into two parts. The extent of convergence of the beam is a measure for the lens power. The sum of and the difference between the intensities of the two parts of the light beam are measured to determine, respectively, the pupil size and the position of the eye with regard to the axis of symmetry of the apparatus. (Author)

**A71-35869 #** The chemical control of ventilation. Søren Claus Sørensen (Copenhagen, University, Copenhagen, Denmark). *Acta Physiologica Scandinavica, Supplementum*, no. 361, 1971. 70 p. 163 refs. NIH Grants No. HE-06285; No. HE-08866; No. GM-09262.

Two sensory systems in mammals: (1) peripheral chemoreceptors and carotid and aortic bodies, and (2) central chemosensitive areas are studied. The chemoreceptors and the central chemosensitive areas are described, and it is shown how these two systems interact during acute changes in arterial PO<sub>2</sub>, PCO<sub>2</sub>, and pH. A review and discussion is then given of evidence that human beings living from the moment they are born in a hypoxic environment exhibit an irreversibly blunted peripheral chemoreceptor response to hypoxia. On this basis, an evaluation is made of the concept that the ventilatory changes observed during chronic hypoxia are secondary to the reflex response to hypoxia mediate by the peripheral chemoreceptors. A review is given also of evidence that ventilation increases during chronic hypoxia in man with a blunted peripheral chemoreceptor response to hypoxia and in animals surgically deprived of their peripheral chemoreceptors. The different mechanisms which may be responsible for ventilatory changes during chronic hypoxia are discussed, and are used as a basis in an analysis of mechanisms which may be responsible for ventilatory adjustments during chronic acid-base disturbances. V.P.

**A71-35891 \*** Sleep of unrestrained chimpanzee - Differences between first and last rapid eye movement periods. F. R. Freeman, J. J. McNew, and W. R. Adey (Marquette University, Milwaukee, Wis.; California, University, Los Angeles, Calif.). *Folia Primatologica*, vol. 13, 1970, p. 144-149. PHS Grant No. NB-02501; Contract No. NSR-05-007-158.

Sleep is not a unique entity but can be divided into 2 separate states called REM (rapid eye movement) and non-REM sleep stages. The present study describes REM sleep in the unrestrained chimpanzee and compares the first REM period which occurs during the night with the last REM period. The last REM period is longer, has more eye movements, more body movements, and possibly a different type of posture than early REM periods. These differences suggest that REM sleep, as is already known for non-REM sleep, changes during the course of the night. (Author)

**A71-35892 \*** Control of somatic cell mitosis by simulated changes in the transmembrane potential level. C. D. Cone, Jr. and M. Tongier, Jr. (NASA, Langley Research Center, Molecular Biophysics Laboratory, Hampton, Va.). *Oncology*, vol. 25, 1971, p. 168-182. 6 refs.

Experiments are described that have been designed to test the premise that variations in intracellular ionic concentrations accompanying different levels of the electrical transmembrane potential difference might serve as a mechanism for control of mitosis in somatic cells. It is shown that the results of these experiments support the validity of the premise. M.V.E.

**A71-35893 \*** Variation of the transmembrane potential level as a basic mechanism of mitosis control. Clarence D. Cone, Jr. (NASA, Langley Research Center, Molecular Biophysics Laboratory, Hampton, Va.). *Oncology*, vol. 24, 1970, p. 438-468. 14 refs.

Formulation of a basic theory of mitosis control assuming the existence of a functional relationship between potential level and mitotic activity, and invoking the precepts of classical membrane potential theory. According to the formulated theory, the intracellular ionic conditions associated with various levels of the potential difference act to regulate deoxyribose nucleic acid (DNA) synthesis and other essential preparations for mitosis. The theory links the activity of the potential-generation mechanisms of the cell surface complex, and hence mitogenic activity, with cellular metabolism and with external environmental influences through an explicit system of interacting feedback circuits. Inherent in the overall theoretical development is the formulation of a unified theory of the cytogenetic etiology and maintenance of the malignant state. Additional specific experimental evidence is cited in support of the theoretical concepts developed. M.M.

**A71-35895 \*** While a monkey waits - Electrocorical events recorded during the foreperiod of a reaction time study. E. Donchin, D. Otto, L. K. Gerbrandt, and K. H. Pribram (NASA, Ames Research Center, Moffett Field, Calif.; Illinois, University, Champaign, Ill.; Stanford University, Palo Alto, Calif.). *Electroencephalography and Clinical Neurophysiology*, vol. 31, Aug. 1971, p. 115-127. 19 refs. NIH Grant No. MH-12970.

Electrical potentials in the frontal, motor and parietal cortex of young rhesus monkeys during three foreperiod reaction time tasks were studied using transcortical Pt-PtCl electrodes, long time-constant amplifiers and computer-averaging techniques. A prominent positive-negative-positive wave form was observed maximally in postcentral cortex when monkeys held a key down during a fixed interval between two stimuli. When response was withheld until the second stimulus, sustained negativity occurred frontally but not postcentrally. The relationship of contingent negative variation, motor potentials and the observed electrocorical patterns is discussed. M.M.

**A71-35896** Analysis of the interrelations between frequency bands of the EEG by means of the bispectrum - A preliminary study. G. Dumermuth, P. J. Huber, B. Kleiner, and Th. Gasser (Zürich, Universität; Eidgenössische Technische Hochschule, Zurich, Switzerland). *Electroencephalography and Clinical Neurophysiology*, vol. 31, Aug. 1971, p. 137-148. 24 refs. Research supported by the Schweizerischer Nationalfonds zur Förderung der Wissenschaftlichen Forschung, the Emil Borell Stiftung der F. Hoffmann-La Roche zur Förderung der Medizinisch-Wissenschaftlichen Forschung, and the Fritz Hoffmann-La Roche-Stiftung zur Förderung Wissenschaftlicher Arbeitsgemeinschaften in der Schweiz.

Brief outline of the principal results of an evaluation of the statistics and practical aspects of the bispectral analysis of the frequency bands of the EEG. It is pointed out that, whereas the

second central moment is analyzed in detail by the power spectrum, the bispectrum allows a detailed analysis of the third central moment, which is influenced either by interrelations between frequency components or by nonstationarity of the signal. The bispectrum may therefore display important additional information about the properties of a stochastic signal like the EEG. In the stationary case this information is of great value in the investigation of phase-locking between different frequency bands. In addition, some new insights into the nonlinear aspects of the EEG generating process might be expected. M.M.

**A71-35907 # Breathing in space.** Tony Nicholson (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Astronomy and Space*, vol. 1, June 1971, p. 25-31, 20, 21.

The advantages and drawbacks of the pure oxygen and oxygen-nitrogen breathing systems are discussed. It was found that breathing pure oxygen has a toxic effect on man. The total red blood cell mass was reduced following a four-day Gemini mission, but following the eight- and fourteen-day flights the red cell mass decreased by 20% and the volume of each cell was increased. In the Apollo spacecraft, pure oxygen was replaced by a two-gas mixture containing 64% O<sub>2</sub> and 36% N<sub>2</sub>. The situations when decompression sickness could arise in the Apollo missions are discussed. The control of contaminants in the breathing system, particularly that of CO<sub>2</sub>, is discussed. Z.W.

**A71-35910 Further improved method for measuring monophasic action potentials of the intact human heart.** Bertil Olsson, Ed Varnauskas, and Magnus Korsgren (Göteborg, Universitet, Göteborg, Sweden). *Journal of Electrocardiology*, vol. 4, no. 1, 1971, p. 19-23. 25 refs. Research supported by the Stiftelsen Carl Yngve Johnsons Fond.

A simple, safe and easily reproduced method of recording the monophasic action potential (MAP) of the intact human heart is described. It involves the use of a special close bipolar electrode catheter. The advantages with this method compared with earlier methods are pointed out on the basis of 57 investigations on 58 patients. Possibilities to analyze MAP from the right atrium and ventricle are illustrated in records of right atrial MAPs during sinus rhythm, atrial flutter, and fibrillation, as well as right ventricular MAPs during sinus rhythm. The method is promising in the explanation of electrocardiographical abnormalities. M.M.

**A71-35911 The path of the electrical center of the human heart determined from surface electrocardiograms.** R. Martin Arthur, David B. Geselowitz, Stanley A. Briller, and Rudolph F. Trost (Pennsylvania, University, Philadelphia, Pa.). *Journal of Electrocardiology*, vol. 4, no. 1, 1971, p. 29-33. 23 refs. PHS Grants No. HE-08805; No. HE-5239, No. 5-T01-GM-00606; No. FR-15.

This path during P, QRS, and T has been derived from measurements of torso shape and surface electrocardiographic potentials alone. The locus of the path is within the heart border throughout the cardiac cycle, in the atria during P and in the ventricles during QRS and T. The general features of the path during P and QRS agree well with the known events of the activation sequence. M.M.

**A71-35912 False complete bilateral bundle branch block - Report of cases.** J. A. Abildskov, Mary Jo Burgess, and Kay Millar (Utah, University, Salt Lake City, Utah). *Journal of Electrocardiology*, vol. 4, no. 1, 1971, p. 58-61. 14 refs. Research supported by the Utah Heart Association; PHS Grants No. HE-12611; No. HE-12612.

Description of two cases in which electrocardiographic evidence of right and left bundle branch block occurred on separate occasions.

Both developed complete atrioventricular (AV) block and the prior evidence of impaired conduction in both bundle branches suggested bilateral bundle branch block as the responsible mechanism. During complete AV block, however, QRS complexes had a supraventricular form incompatible with bilateral bundle branch block. The cases are reported as evidence that bilaterally impaired bundle branch conduction does not establish bilateral bundle branch block as the mechanism of complete AV block. M.M.

**A71-35913 Pericarditis revisited.** T. M. Kazemias (San Diego County University Hospital, San Diego, Calif.) and R. H. Wasserburger (U.S. Veterans Administration Hospital; Wisconsin, University, Madison, Wis.). *Journal of Electrocardiology*, vol. 4, no. 1, 1971, p. 62-66. 24 refs.

Results of a correlative electrocardiographic survey of patients with surgically proven constrictive pericarditis. When constrictive pericarditis predominantly involves the left ventricle and extends up to the left atrioventricular groove, a fairly distinctive EKG is seen, consisting of right axis deviation and vertical cardiac position, variable degrees of T-wave inversion over the posterolateral wall of the left ventricle and notching and widening of the left atrial P-waves. It is pointed out that although these findings are not diagnostic, they should alert the clinician to search for confirmatory evidence of chronic constrictive pericarditis, a remedial cardiac lesion. M.M.

**A71-35918 Fibrinolytic response to physical exercise in males.** B. Berkarda, G. Akokan, and U. Derman (Istanbul Üniversitesi, Istanbul, Turkey). *Atherosclerosis*, vol. 13, Jan.-Feb. 1971, p. 85-91. 16 refs.

The authors investigated changes in coagulation and fibrinolysis which occurred after moderate physical exercise in young normal males, aged normal males and male patients with complications of atherosclerosis. It was found that all three groups developed a hypercoagulable state of similar intensity after exercise, while the fibrinolytic response differed in each; the increase was on the order of 140% in young normal males, 40% in aged normal males, and 20% in the atherosclerotic patients. It therefore seems that the homeostatic equilibrium which in young normal individuals exists between the response of coagulation and that of fibrinolysis to exercise, tends to disappear with increasing age and with the occurrence of atherosclerotic complications. (Author)

**A71-35919 Acid mucopolysaccharides of fatty streaks in young, human male aortas.** E. R. Dalferes, Jr., H. Ruiz, V. Kumar, B. Radhakrishnamurthy, and G. S. Berenson (Louisiana State University, New Orleans, La.). *Atherosclerosis*, vol. 13, Jan.-Feb. 1971, p. 121-131. 39 refs. PHS Grants No. HE-02942; No. HE-08974.

The mucopolysaccharide (MPS) content and composition of fatty streaks (posterior thoracic and abdominal aorta) were compared to carefully selected involved aortic intima (anterior thoracic). An altered composition of MPS in the very earliest lesions occurring in adolescent males was observed. An increase of MPS, chondroitin sulfate C in particular, was found in the fatty streaks associated with spindle cell and extracellular lipid in 12 to 25 year age group. The area of the aorta more susceptible to atherosclerosis showed the most striking changes. These studies are a further indication that MPS contribute to the development of fatty streaks, likely through their interaction with lipids. (Author)

**A71-35955 Laser-induced retinal damage.** S. F. Cleary and P. E. Hamrick (Virginia Commonwealth University, Richmond, Va.). *Non-Ionizing Radiation*, vol. 2, Mar. 1971, p. 1-10. 23 refs.

A model for laser-induced retinal damage is proposed on the basis of known modes of interaction of laser energy with physical

systems, including transient temperature rises, acoustic transients, vaporization, and dielectric breakdown. Available information on conditions for induction of each effect is used to predict occurrence in the retina. A study of some of the effects in a physical model of the retina is described and related to the corresponding effects detected by in vitro studies of the rabbit eye. The mode of interaction in the retina depends on laser energy and power density, and all modes can be induced at sufficiently high energy densities. Enhanced damage potential of Q-switched lasers, over normal mode and c.w. lasers, is due to both the intense pressure transients generated and a greater temperature rise. At high energy densities tissue vaporization is the dominant mode of damage. (Author)

**A71-35956 Pathophysiological aspects of microwave irradiation. II.** Sol M. Michaelson (Rochester, University, Rochester, N.Y.). *Non-Ionizing Radiation*, vol. 2, Mar. 1971, p. 27-38. 96 refs.

Aspects of the quantization of the biological response to microwaves are considered, and the effects of EM radiation of various types on the eyes are discussed giving particular attention to microwave effects. Effects of microwaves on the testes are indicated in several studies, and there are some experimental data on the effect of microwaves on the development of the chick embryo. Studies of an alteration in the electrophoretic, immunological and enzymatic activity of proteins by exposure to microwaves and rf waves are reported together with investigations showing decreased incorporation of labeled amino acid into liver and testes. Other subjects investigated include genetic effects, pearl-chain formation, central nervous system effects, and cardiovascular effects. G.R.

**A71-35994 In vitro cytotoxic effect of L-glutaminase on leukaemic lymphocytes.** Robert Schrek (U.S. Veterans Administration Hospital, Hines, Ill.), John S. Holcenberg, Joseph Roberts, and William C. Dolowy (Washington, University, Seattle, Wash.). *Nature*, vol. 232, July 23, 1971, p. 265. 8 refs. Research supported by the Leukemia Research Foundation and PHS.

In vitro investigation in which blood lymphocytes from patients with chronic lymphocytic leukemia were found to be more sensitive than normal lymphocytes to incubation with L-asparaginase but not as sensitive as 6C3HED mouse lymphoma which responds in vitro to the enzyme. The slide chamber method (Schrek, 1958) was used to compare the sensitivity of normal and leukemic lymphocytes to glutaminase. The experimental findings suggest that the decrease of glutamine in the media killed leukemic but not normal lymphocytes in vitro. M.M.

**A71-35999 Biomedical requirements for aerodromes.** Siegfried J. Gerathewohl (FAA, Washington, D.C.). *Airport Forum*, no. 2, 1971, p. 65-67 (4 ff.). 18 refs. In English and German.

A team of aeromedical specialists surveyed 106 airports within the U.S. in 1961. Medical support for airport operation was found to be lacking as compared to other advances in aviation, and it was recommended that a reasonable minimal level of protection be provided for the users of the airports. Particularly noticeable was the lack of adequate emergency planning at many airports for handling major aviation disasters which may occur in the vicinity of an airport. The medical supervision of the physical and mental health levels of flight crews, maintenance and air traffic control personnel is a very important factor in averting aircraft accidents. The various tasks for the airport medical service are discussed together with aspects of a systems approach to airport medicine. G.R.

**A71-36001 The kinetics of cone visual pigments in man.** Matthew Alpern, Frode Maaseidvaag (Michigan, University, Ann Arbor, Mich.), and Norio Ohba. *Vision Research*, vol. 11, June 1971, p. 539-549. 6 refs. Research supported by the University of Michigan; NIH Grant No. EY-00197-12.

Rushton's general kinetic equation for human cone pigments is tested by estimating the photolysis rate at equilibrium from the initial photolysis rate and comparing it to the equilibrium rate of regeneration measured immediately after the bleaching light is turned off. Thirty-seven experiments carried out at a variety of intermediate bleaches confirm the validity of this equation. The hypothesis that the regeneration rate depends on the store of 11-cis retinal leads to the expectation that recovery from a prolonged weak bleach will proceed with a shorter time constant than recovery from a long intense bleach, and this is not found. This could happen if even the prolonged weak bleach depleted the 11-cis store but this possibility is excluded by an experiment in which recovery is measured following 5-sec full bleaching which follows straight on a prolonged weak one. Why recovery from short full bleaches proceeds twice as fast as recovery from long full ones remains unexplained. M.M.

**A71-36002 Visual conspicuity, directed attention and retinal locus.** F. L. Engel (Institute for Perception Research, Eindhoven, Netherlands). *Vision Research*, vol. 11, June 1971, p. 563-575. 22 refs.

Suggestion of a method for measuring the visual conspicuity of an object in its background. Associated with each object is a conspicuity area, which is defined as the retinal area within which the object to be searched for is seen in a brief presentation. The size of this area can be used as a measure of visual conspicuity. Directing attention toward a certain location in the retinal field influences the shape of the retinal area concerned. Visibility and visual conspicuity turned out to be linked by directed attention. The experimental results are interpreted in terms of external and internal determiners of attention. M.M.

**A71-36003 The direct estimation of the luminosity of coloured light sources.** C. A. Padgham (London, University, London, England). *Vision Research*, vol. 11, June 1971, p. 577-590. 26 refs.

The Helmholtz-Kohlrausch effect has been investigated using the method of direct estimation of luminosity. This effect is the increase of luminosity of a colored stimulus with increase of purity at constant luminance. The luminosity of twelve hues each at two levels of purity, and a white, all with a dark surround, has been directly assessed by three observers at seven levels of luminance. The results show a positive effect in most cases, and in some instances the effect is quite large. The origin of the effect is discussed, together with the difficulty of relating luminance to luminosity especially when the stimulus appears fluorescent or brilliant. The relevance of the concept of 'equivalent luminance' is mentioned. M.M.

**A71-36004 The perception of color with achromatic stimulation.** Leon Festinger, Mark R. Allyn, and Charles W. White (New School for Social Research, New York, N.Y.). *Vision Research*, vol. 11, June 1971, p. 591-612. 30 refs. NIH-supported research; NSF Grant No. GB-8178.

A series of experiments demonstrated that the flicker colors can be produced by appropriate changes in the intensity of a stationary light source. If the intensity changes resemble those produced by a Benham Top, then lateral inhibitory effects from a flickering background must be present to produce the colors. Patterns of temporal intensity changes were discovered by means of which the flicker colors were produced with a constant background. M.M.

**A71-36011 # Dark adaptation in strabismic amblyopia - The use of colored filters.** J. T. Flynn and J. S. Glaser (Miami, University, Miami, Fla.). *Ophthalmic Research*, vol. 2, no. 1, 1971, p. 1-15. 33 refs. NIH Grant No. EY-00376-02.

The dark adaptation curves to colored test targets of 26

amblyopic subjects were studied. Their normal eyes were used as controls. No defects were found in the group having foveal fixation, but significant defects were uncovered in the group having eccentric fixation. These differences will be discussed and an hypothesis advanced to account for the defects in the eccentric fixers. (Author)

**A71-36068** Image transformation on the retina. Kiyoe Mizusawa (Pennsylvania State University, University Park, Pa.). In: Photo-optical instrumentation for the 70's; Society of Photo-optical Instrumentation Engineers, Annual Technical Symposium, 15th, Anaheim, Calif., September 14-17, 1970, Proceedings.

Symposium co-sponsored by the U.S. Air Force and the U.S. Army. Redondo Beach, Calif., Society of Photo-optical Instrumentation Engineers (SPIE Annual Technical Symposium Proceedings, Volume 3), 1971, p. 257-260. 7 refs.

Discussion of the unique properties and functions of photosensitive cells of the retina compared with the photosensitive chemicals of films, with emphasis on the image transformation processes of the retina. On the basis of previous research, it is considered that the binocular interaction in the detection threshold occurs in the peripheral region of the retina where the rods are mainly distributed. F.R.L.

**A71-36091 \*** An eye-point-of-regard system for use in scanning and display research. Richard H. Klein and Henry R. Jex (Systems Technology, Inc., Hawthorne, Calif.). In: Photo-optical instrumentation for the 70's; Society of Photo-optical Instrumentation Engineers, Annual Technical Symposium, 15th, Anaheim, Calif., September 14-17, 1970, Proceedings.

Symposium co-sponsored by the U.S. Air Force and the U.S. Army. Redondo Beach, Calif., Society of Photo-optical Instrumentation Engineers (SPIE Annual Technical Symposium Proceedings, Volume 3), 1971, p. 543-551. 14 refs. Contract No. NAS 2-3746.

A system for measuring the eye-point-of-regard in a reference surround is described and validated. It comprises three sub-assemblies: an electrooptical eye movement device, an electro-mechanical head movement device, and an analog computer for mixing and shaping. Applications of the system have included the measurement of pilot eye fixations and scanning traffic during simulated instrument approaches in a jet transport simulator, a study of the effects of motion cues on pilot's scanning behavior during simulated helicopter hovering, and the measurement of information use with peripheral displays. Unique to the system are ease of setup and the separate as well as combined electrical output of eye and head signals for on-line statistical analysis, recording, or monitoring of eye-point-of-regard. M.M.

**A71-36103** Effects of target value and exposure duration on recall in a visual search task. Harvey A. Taub (U.S. Veterans Administration Hospital; New York, State University, Syracuse, N.Y.) and Charles Abrams (Human Factors Research, Inc., Santa Barbara, Calif.). *Journal of Applied Psychology*, vol. 55, Aug. 1971, p. 393-398.

The present study was designed to investigate the effects of exposure duration (.5, .75, 1.0, 2.0, and 3.0 sec per slide) and ratio of value (16:1 and 2:1) on the recall of high- and low-value letters in a visual search task. The results indicated that although Ss' strategies tended to favor reports of the high-value over the low-value stimuli, differences in performance varied directly with both ratio and length of exposure. These results were discussed in terms of their general implications and were related to the inconsistencies in the findings reported in the previous literature. (Author)

**A71-36138** Left ventricular aneurysm - Analysis of electrocardiographic features and postresection changes. Dennis V. Cokkino, Grady L. Hallman, Denton A. Cooley, Oscar Zamalloa,

and Robert D. Leachman (St. Luke's Episcopal Hospital; Texas Heart Institute, Houston, Tex.). *American Heart Journal*, vol. 82, Aug. 1971, p. 149-157. 27 refs. NIH Grant No. FR-00259.

Findings of a statistical analysis of the ECGs of 26 patients recorded before and after aneurysmectomy: (1) aneurysms are more frequent in men. Anterior locations predominate. 'Older' aneurysms are not larger; (2) the ECG axis, loss of R-wave positivity, or degree of S-T-segment elevation cannot predict the size of the aneurysm. In contrast, increased QRS duration and body surface distribution of abnormal Q waves suggestive of myocardial necrosis correspond to larger aneurysms; (3) after aneurysmectomy R-wave positivity increases and abnormal Q waves and S-T-segment elevation diminish and may even disappear; and (4) in contrast to right axis deviation which diminishes and may even disappear after aneurysmectomy, left axis does not change significantly. This different behavior may be due to the different etiology of these axis deviations. Right deviation is probably caused by loss of left-sided potentials, while left axis deviation is frequently produced by left anterior hemiblock. M.M.

**A71-36139** Selective cine coronary arteriography and vectorcardiographic diagnoses - Correlative study of one hundred patients. Barry J. Maron, Ronald H. Selvester, and Eugene J. Ellis (Hospital of the Good Samaritan, Los Angeles, Calif.). *American Heart Journal*, vol. 82, Aug. 1971, p. 163-170. 22 refs.

Coronary artery narrowing was estimated and correlated with vectorcardiographic (VCG) diagnoses of myocardial infarcts and/or fibrosis. A significant statistical correlation was found between the presence of severe coronary artery disease and VCG evidence of large myocardial infarcts. VCG diagnoses of 'small' and 'medium' lesions had no statistical correlation with hemodynamically significant coronary artery disease. There was no significant statistical correlation between coronary arteriographic findings and VCG localization of infarcts. The VCG appears to be a useful clinical adjunct in the diagnosis of severe coronary artery disease and large myocardial infarcts. However, there is no evidence that smaller lesions predicted by VCG relate to the size or location of small scars in the myocardium. M.M.

**A71-36140** Durations and intervals of normal heart sounds in man. C. Aravanis, L. Feigen, and A. A. Luisada (University of Health Sciences, Chicago, Ill.). *American Heart Journal*, vol. 82, Aug. 1971, p. 187-192. 8 refs.

The duration of the heart sounds, the Q-I interval, and the intervals between sounds, as well as between their components, were studied in 23 normal subjects. The study was made with new calibrated equipment which records displacement, velocity, and acceleration tracings, and which contains provisions for the application of different filters. The data obtained will serve for the evaluation of those found in clinical cases. M.M.

**A71-36213** Exercise and cardiac death. Edited by E. Jokl and J. T. McClellan (Kentucky, University, Lexington, Ky.). Basel, S. Karger AG (Medicine and Sport, Volume 5), 1971. 194 p. \$11.20.

Four pathological syndromes that have been discovered during autopsy in cases of sudden unexpected death associated with physical exertion are discussed. By far the most frequent postmortem findings in cases of sudden cardiac death associated with exercise are coronary athero- and arteriosclerosis, elaborating with observations of sudden cardiac deaths of pilots in flight. Congenital anomalies of the coronary arteries are another potential cause of death of seemingly healthy persons. Autopsy findings of myocarditis, and cardiac tumors are among other subjects covered. Subject and author indexes are provided.

G.R.

**A71-36214** Acute fatal non-traumatic collapse during work and sport. E. Jokl and L. Melzer (Kentucky, University, Lexington, Ky.). In: Exercise and cardiac death. Edited by E. Jokl and J. T. McClellan. Basel, S. Karger AG (Medicine and Sport. Volume 5), 1971, p. 5-18. 73 refs.

The object of this investigation was to ascertain whether physical strain could lead to fatal collapse due to pathological processes other than those so far known to be responsible for sudden death. A table listing 43 cases of acute fatal nontraumatic collapse during sport and work is presented. In the instances of death considered, autopsy revealed the presence of pathological conditions, in the great majority of long standing and of great severity. Not one instance was encountered in which death could be regarded as due to the effects of extreme exertion on a previously healthy heart. It is significant that there is no case in which death occurred during a physical performance longer and more intense than that in which the deceased had usually indulged. G.R.

**A71-36215** Mechanisms involved in acute fatal non-traumatic collapse associated with physical exertion. E. Jokl and M. M. Suzman (Kentucky, University, Lexington, Ky.). In: Exercise and cardiac death. Edited by E. Jokl and J. T. McClellan. Basel, S. Karger AG (Medicine and Sport. Volume 5), 1971, p. 19-24. 20 refs.

An analysis of 66 cases, in which clinical data as well as complete autopsy reports were available, revealed that collapse associated with exertion is almost invariably due to circulatory disease of long standing. In no case in which death occurred in connection with physical exertion was the subject found at autopsy to be free of serious disease. The physiologic phenomena considered include the biphasic reaction of the arterial blood pressure to exercise, expiratory effort, and the gastrocoronary reflex. G.R.

**A71-36216** Sudden cardiac death of pilots in flight. E. Jokl and J. T. McClellan (Kentucky, University, Lexington, Ky.). In: Exercise and cardiac death. Edited by E. Jokl and J. T. McClellan. Basel, S. Karger AG (Medicine and Sport. Volume 5), 1971, p. 25-63. 49 refs.

'Silent' ischemic heart disease is the cause of unforeseen episodes of unconsciousness, confusion, amnesia, and sudden death in pilots, by far the most important clinical problem in aviation medicine. Attention is given not only to cardiac problems but also to other clinical conditions that can cause unheralded episodic unconsciousness, confusion, amnesia, syncope, and death during flight. A number of cases are described in which accidents in aviation were due to incapacitation from cardiovascular disease. G.R.

**A71-36217** Congenital anomalies of coronary arteries as cause of sudden death associated with physical exertion. J. T. McClellan and E. Jokl (Kentucky, University, Lexington, Ky.). In: Exercise and cardiac death. Edited by E. Jokl and J. T. McClellan. Basel, S. Karger AG (Medicine and Sport. Volume 5), 1971, p. 91-98. 9 refs.

Autopsy findings of congenital abnormalities of coronary arteries are reported. In the cases considered the individuals died suddenly in association with physical exertion. The persons involved include an international rugby player, an pneumatic drill operator, and several boys. The adults were in their twenties or early thirties at the time of death, while the boys died at the ages of 11, 14, and 16 years, respectively. Anomalies reported included generalized hypertrophy of coronary artery, a left coronary artery originating from the pulmonary, the absence of a left coronary artery, and a case in which both coronary arteries originated from the common funnel in the right aortic sinus. G.R.

**A71-36218** Nephropathy associated with heat stress and exercise. R. W. Schrier (California, University, San Francisco, Calif.), H. S. Henderson (Tennessee, University, Knoxville, Tenn.), C. C. Tisher (Duke University, Durham, N.C.), and R. L. Tannen (Vermont, University, Burlington, Vt.). In: Exercise and cardiac death. Edited by E. Jokl and J. T. McClellan. Basel, S. Karger AG (Medicine and Sport. Volume 5), 1971, p. 121-147. 36 refs.

Eight patients with acute renal failure associated with heat stress and physical exercise were treated at Walter Reed General Hospital between 1960 and 1966. All of the cases occurred during the summer in recruits participating in their initial 2 months of basic training. The renal pathological findings revealed enlarged kidneys without histological evidence of glomerular alterations or tubular necrosis. These findings emphasized the discrepancy between the physiological alterations and the histopathological abnormalities. Dehydration, vascular collapse, hyperpyrexia, and pigmenturia (myoglobinuria or hemoglobinuria or both) were all considered to play varying etiological roles in these cases of acute renal failure associated with heat stress and exercise. G.R.

**A71-36229 \*** Long-wavelength ultraviolet photoproduction of amino acids on the primitive earth. Carl Sagan (Cornell University, Ithaca, N.Y.) and Bishun N. Khare (Smithsonian Astrophysical Observatory; Harvard University, Cambridge, Mass.). *Science*, vol. 173, July 30, 1971, p. 417-420. 26 refs. Research supported by the Smithsonian Institution and PHS; Grant No. NGR-33-010-101.

In the experiments described, hydrogen sulfide was used as the initial photon acceptor. The effect of the following factors on the photoproduction of amino acids was studied: (1) composition of the precursor gases, (2) use of one or two Hg resonance lines, (3) the gas temperature, and (4) the time history of irradiation. It was found that H<sub>2</sub>S is an acceptable long-wavelength photon acceptor for prebiological organic chemistry. The 1849 Å line is not necessary for the production of amino acids, but initial ethane is. Ethane is a likely product of electrical discharge and short-wavelength UV irradiation of methane. Temperatures higher than plausible mean surface temperatures are not required. A quantum yield above 0.00005 and an efficiency number greater than 6,000,000 amino acid molecules per erg are implied. Cystine and therefore perhaps other sulfur-containing amino acids can be produced in simulated prebiological conditions. Z.W.

**A71-36230 \*** Evidence for compounds hydrolyzable to amino acids in aqueous extracts of Apollo 11 and Apollo 12 lunar fines. Kaoru Harada, C. R. Windsor, S. W. Fox (Miami, University, Coral Gables, Fla.), and P. E. Hare (Carnegie Institution of Washington, Washington, D.C.). *Science*, vol. 173, July 30, 1971, p. 433-435. 21 refs. Contract No. NAS 9-8101.

Hydrolyzates of aqueous extracts of Apollo 11 fines, an Apollo 12 trench sample, and an Apollo 12 surface sample have been analyzed on an ultrasensitive amino acid analyzer. The total content of amino acids recovered ranged from 20 to 70 parts per billion of lunar soil. Amino acids are not recovered by the direct hydrolysis of lunar fines, presumably because of decomposition in the presence of the large excess of lunar mineral. As judged by retention time, glycine is the dominant amino acid found; alanine is secondarily present in each case in the profile. Only a few amino acids have been recorded in each analysis. The pattern is relatively consistent in the samples from the three locations; the pattern from either hydrolyzed or unhydrolyzed extracts differs markedly from that of hydrolyzed or unhydrolyzed handprints. The evidence is not consistent with contamination of the kind expected by many investigators. (Author)

**A71-36231 \*** Thymine - A possible prebiotic synthesis. E. Stephen-Sherwood, J. Oro, and A. P. Kimball (Houston, University, Houston, Tex.). *Science*, vol. 173, July 30, 1971, p. 446, 447. 17 refs. Grant No. NGR-44-005-002.

Thymine was obtained when uracil, paraformaldehyde, and hydrazine were heated in an ammoniacal solution for three days at 70 C. The thymine was isolated by means of two-dimensional preparative paper chromatography. The similarity of this particular abiotic synthesis to the normal biological pathway is pointed out.

Z.W.

**A71-36232 Eye-head coordination in monkeys - Evidence for centrally patterned organization.** Emilio Bizzi, Ronald E. Kalil, and Vincenzo Tagliasco (MIT, Cambridge, Mass.). *Science*, vol. 173, July 30, 1971, p. 452-454. 7 refs. NIH Grant No. 1-R01-NA09343-01.

Eye-head coordination was investigated by recording from the neck and eye muscles in monkeys. The results show that (1) during eye-head turning, neural activity reaches the neck muscles before the eye muscles, and (2) all agonist neck muscles are activated simultaneously regardless of the initial head position. Since overt movement of the eyes precedes that of the head, it was concluded that the central neural command initiates the eye-head sequence but does not specify its serial order. Furthermore, it was determined that the compensatory eye movement is not initiated centrally but instead is dependent upon reflex activation arising from movement of the head. (Author)

**A71-36238 # Effect of prolonged strenuous exercise on the concentration of triglycerides, phospholipids and glycogen in muscle of man.** Sven O. Fröberg (Uppsala, Universitet, Uppsala, Sweden) and Folke Mossfeldt (King Gustaf Vth Research Institute, Stockholm, Sweden). *Acta Physiologica Scandinavica*, vol. 82, June 1971, p. 167-171. 21 refs. Research supported by the Konung Gustaf Vth's 80-årsfond and the Swedish Medical Research Council.

Study of muscle tissue from the lateral vastus of the femoral muscle taken by the needle biopsy technique in seven male subjects before and after strenuous exercise by skiing for about seven hours. The mean muscle triglyceride concentration decreased from 17 to 8 micromoles/g wet weight during the exercise. No change was observed in the phospholipid concentration. The mean glycogen concentration in the muscle decreased from 16 to 7 mg/g wet weight during the exercise. The results indicate that not only muscle glycogen but also muscle triglycerides are of importance for the energy metabolism in man during exercise. (Author)

**A71-36239 # Dynamics of arterial oxygen tension in response to sinusoidal work load in man.** Hilding Bjurstedt and Ove Wigertz (Kungl. Karolinska Institutet, Stockholm, Sweden). *Acta Physiologica Scandinavica*, vol. 82, June 1971, p. 236-249. 17 refs. Research supported by the Swedish Medical Research Council.

Study of the dynamic characteristics of the response of arterial O<sub>2</sub> tension (P sub aO<sub>2</sub>) to supine submaximal leg exercise in seven physically active young men. P sub aO<sub>2</sub> was recorded continuously in the radial artery at the wrist; work load was varied sinusoidally between the extremes of 250 and 1050 kpm/min with periods of 0.75, 1.5, 3.0, and 7.0 min. Time-averaging harmonic analysis showed a clear dominance of the fundamental component over the second and third harmonics in the P sub aO<sub>2</sub> response, indicating approximately linear properties of the underlying system within the work-load region studied. The transfer function for P sub aO<sub>2</sub>, exhibiting the characteristics of a variable regulated within narrow limits in the steady-state condition, indicated that the basic response of P sub aO<sub>2</sub> to a change in work load is a transient change in the opposite direction preceded by a pure time delay. Resonance occurred for work-load periods near 3.0 min (peak-to-peak deviations approaching 14 mm Hg). Referring P sub aO<sub>2</sub> changes to blood entering the left heart, the estimated time delay before a change in work load resulted in a change in P sub aO<sub>2</sub> amounted to 15 sec. The existence of a resonance is interpreted in terms of an unbalance between factors determining O<sub>2</sub> uptake from, and supply to, the alveolar space. (Author)

**A71-36240 # Dynamics of arterial blood pressure responses to sinusoidal work load in man.** Gunnar Rosenhamer and Ove Wigertz (Kungl. Karolinska Institutet, Stockholm, Sweden). *Acta Physiologica Scandinavica*, vol. 82, June 1971, p. 250-263. 18 refs.

Systolic, diastolic, mean and pulse pressures in the radial artery, and heart rate in 7 physically active young men were subjected to frequency analysis by using sinusoidal work load as a forcing function. Subjects exercised in the supine position on a cycle ergometer. With the pedaling rate constant, the work load was varied sinusoidally over a range of drive frequencies between the two fixed extremes of 250 and 1050 kpm/min. Predicted step responses obtained by applying the transfer functions estimated for radial systolic and pulse pressures showed close similarity to observed step responses, indicating linear properties of the underlying systems. Using known characteristics of the peripheral distortion of the pressure pulse, the responses of both the radial and central systolic and pulse pressures to work load could be described by second-order transfer functions. Resonance occurred for periods near 7 min, indicating overshoots for both variables in the time domain. This behavior suggests baroreflex inhibition as an explanation of an overdamped response of the heart rate. The changes in radial diastolic pressure were small and not clearly related to the drive frequency. The response of the radial mean pressure could not be described accurately by either first- or second-order functions, but exhibited phase lead features, suggesting sensitivity to rate of change in work load. (Author)

**A71-36278 \* # An experimental study on the visual detection of stars in a spacecraft environment.** R. P. Heinisch (Honeywell, Inc., St. Paul, Minn.). *Journal of Spacecraft and Rockets*, vol. 8, Aug. 1971, p. 852-858. 7 refs. Contract No. NAS 2-5015.

Investigation of the possibility of predicting the magnitude of a star which can be seen with the naked eye or a sextant telescope through a spacecraft window. The effects of geometry and window coating were considered. Scattering luminance of typical spacecraft windows was measured. Window illumination from the sun, moon, and earth was computed for typical orbit conditions. Stellar magnitude thresholds were predicted from the scattering data and window illuminations by applying the classical Tiffany visual threshold data. The stellar thresholds indicate that window cleanliness is of paramount importance in reducing light scattering. Scattering measurements reveal that quality of the antireflection coating on windows has more influence on the scattering level than the type of coating per se. The stellar magnitude thresholds are given for the telescope and the naked eye at the location of maximum, minimum, and average scatter. In general, using a telescope, an astronaut in a spacecraft that is distant from the earth or moon will be able to see stars less bright than a magnitude of 2.00. M.M.

**A71-36296 # Human factors engineering.** Leslie Buck (National Research Council, Control Systems Laboratory, Ottawa, Canada). *Canada, National Research Council, Division of Mechanical Engineering and National Aeronautical Establishment, Quarterly Bulletin*, no. 1, 1971, p. 19-26. 9 refs.

As a separate, well-defined field of study, human factors engineering dates from the Second World War, when the results of technological development were being applied in situations that placed exceptional demands upon operators. The subject known as industrial psychology was very largely oriented towards personnel selection and training. The significance of operator motivation is examined. Human factors engineering takes into account the fact that in building a system for operation by a human being one must consider human limitations capabilities. Subjects discussed include questions of applied experimental psychology, research on attention, engineering psychology and ergonomics. Characteristics of perpetual motor skills are explored, and a brief account of studies of stress effects and movement control is presented. G.R.

**A71-36368 \* #** Application of reverse osmosis to wash water recovery for manned space flights. L. M. Kindley, H. E. Podall (U.S. Department of the Interior, Office of Saline Water, Washington, D.C.), and J. N. Pecoraro (NASA, Biotechnology Branch, Washington, D.C.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-1.* 10 p. 7 refs. Members, \$1.00; nonmembers, \$3.00.

Reverse osmosis is one of the separation processes being investigated for renovation of wash water in manned space missions. The simplicity of the process and the versatility attainable by a tailoring of the membranes are the main features which make this an attractive candidate for water recovery in a space environment. Since the membrane is the key element of the reverse osmosis process, most of the investigations to date have been aimed at developing membranes capable of effecting the required purification at high water recovery while operating under sterile conditions for the duration of the space mission. Problems arising during these investigations and preliminary results are described. (Author)

**A71-36369 \* #** Development of a zero-gravity whole body shower. A. A. Rosener, D. M. Parker, S. C. Harris (Martin Marietta Corp., Denver, Colo.), and J. B. Hall, Jr. (NASA, Langley Research Center, Hampton, Va.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-2.* 10 p. Members, \$1.00; nonmembers, \$3.00. Contract No. NAS 1-8919.

Following the analytical and scale model testing, a prototype shower system was constructed to evaluate the various shower concepts in both one- and zero-gravity environments. The system provided the capability for collecting water by the air drag method, the vacuum collection technique, and the evaporation technique. The airflow system consisted of the blower, ducting, dampers, heaters, and controls, and allowed variation of the airflow rate from 200 to 1100 cu ft per min. The dampers also allowed the system to dump all air and receive fresh air, to dump a percentage of the air, and to completely recirculate the air. A large vortex liquid/gas separator was located in the main air duct system and was utilized with the air drag and evaporation methods of water removal from the shower stall. The zero-gravity test data proved that a whole body shower is feasible and that showering in zero gravity is no more difficult than showering at 1 g. Z.W.

**A71-36370 \* #** Life-support system operational and maintenance data for the 90-day space station simulator test. M. S. Bonura and L. G. Barr (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-3.* 21 p. 8 refs. Members, \$1.00; nonmembers, \$3.00. Research supported by the McDonnell Douglas Astronautics Independent Research and Development Program; Contract No. NAS 1-8997.

Operational and maintenance data are presented for a 90-day manned test of an advanced regenerative life-support system which was conducted in a Space Station simulator with a crew of four. The test featured closed-chamber operation with no resupply - i.e., all expendables were onboard at the start of the test, including spares, makeup water, tools, and food. The crew was required to monitor, maintain, and repair the equipment installed in the simulator. During the test, the crew performed 212 maintenance and repair tasks on the life-support equipment. The regenerative life-support system produced 1,069.9 kg (2,356.7 lb) of potable water, 4,743.2 kg (10,447.6 lb) of wash water, and 267.14 kg (588.42 lb) of oxygen.

Data are presented on life-support equipment operation, maintenance activity, spares provision, mass balance, and thermal balance. (Author)

**A71-36371 \* #** Integrated waste management - Water system using radioisotopes for thermal energy. R. W. Murray (General Electric Co., Life Systems Div., Philadelphia, Pa.), R. W. Shivers (AEC, Div. of Isotopes Development, Washington, D.C.), A. L. Ingelfinger (NASA, Office of Manned Space Flight, Washington, D.C.), and C. A. Metzger (USAF, Wright-Patterson AFB, Ohio). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-4.* 9 p. Members, \$1.00; nonmembers, \$3.00. AEC-NASA-USAF-supported research.

A complete integrated system capable of collecting and processing wastes from four men for a 180-day space mission is being developed by General Electric under a jointly funded AEC/NASA/AF Contract. The system provides feces, trash, and urine collection; water reclamation; storage, heating and dispensing of the water; storage and disposal of the feces and urine residue and all other nonmetallic waste material by incineration. The heat required for the 1200 F purification processes is provided by a single 400-w radioisotope heater. (Author)

**A71-36372 \* #** Wide heat load range space radiator development. R. J. Tufte (Vought Missiles and Space Co., Dallas, Tex.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-5.* 14 p. 5 refs. Members, \$1.00; nonmembers, \$3.00. NASA-supported research.

Current EC/LS system planning for advanced space missions includes requirements for much wider ranges of waste heat rejection than have been encountered in previously designed systems. The development of an EC/LS space radiator heat rejection system designed to satisfy these requirements by use of stagnation control is described. The stagnation control method eliminates the usual radiator fluid freezing point operational limit by providing controlled freezing and thawing of the radiator fluid. The initial application of this concept to Apollo radiators with 2.5/1 heat load range (high load/low load) is briefly discussed. Design and feasibility testing of design advancements which provided a 30/1 load range are discussed as well as the latest development test program which demonstrated a load range of approximately 200/1. (Author)

**A71-36373 \* #** Water management results for a 90-day space station simulator test. D. F. Putnam, E. C. Thomas, and G. V. Colombo (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-6.* 39 p. 5 refs. Members, \$1.00; nonmembers, \$3.00. Research supported by the McDonnell Douglas Astronautics Independent Research and Development Program; Contract No. NAS 1-8997.

Water management subsystem data are presented for a four-man 90-day test conducted in a Space Station Simulator with closed water and oxygen loops and no resupply. All expendables including food, urine pretreatment chemicals, filter beds, and machinery spare parts were stored onboard and no pass-ins were made during the test. Elements of the subsystem were: (1) isotope-heated VD-VF unit; (2) wick evaporator and humidity control unit; (3) detoxification-multifiltration unit; (4) potable water storage and distribution system; (5) backup potable water supply; and (5) wash water

recovery unit. The performance data include mass and energy balances, water chemistry, and microbiological profiles. Pretest qualification procedures are covered as well as operating protocol used during the manned test.

(Author)

**A71-36374 #** Waste management for the 90-day Space Station Simulator test. R. E. Shook and G. W. Wells (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-7*. 12 p. 6 refs. Members, \$1.00; nonmembers, \$3.00.

Waste management subsystem data are presented for a four-man, 90-day test conducted in the Space Station Simulator. All supplies, parts, and expendables were onboard and no resupply was allowed. Waste management objectives included: control of odor and bacterial contamination of the simulator, minimum crew handling of waste, convenience of operation and maintenance, and design for zero-gravity operation. Elements of the waste management subsystem were: (a) commode unit, (b) urine collection unit, (c) waste storage and disposal consisting of a waste storage container, a toilet paper dryer, a canner, a baler, and a waste liquid overboard pump. The performance data include operational characteristics, input and storage factors, microbiological profiles, and maintenance records.

(Author)

**A71-36375 \* #** Design and performance of a solid electrolyte oxygen generator test module. J. Weissbart, W. H. Smart (Applied Electrochemistry, Inc., Sunnyvale, Calif.), and T. Wydeven (NASA, Ames Research Center, Moffett Field, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-8*. 7 p. 7 refs. Members, \$1.00; nonmembers, \$3.00.

A six-drum, twelve-cell, 24-ampere, CO<sub>2</sub>-H<sub>2</sub>O electrolyzer was operated continuously for over 2000 hr at 870 C and 100 mA/sq cm, with a faradaic efficiency for oxygen of 100%, 0.4% maximum CO<sub>2</sub> in the oxygen stream, and fluctuation in the applied voltage of only 10%. The average single cell voltage during the 2000-hr test was 1.80 V. The feed gas was CO<sub>2</sub> saturated with water vapor at room temperature. The module was made up of two-cell drums constructed from several electrolyte disks of the composition (ZrO<sub>2</sub>)<sub>0.93</sub>(Sc<sub>2</sub>O<sub>3</sub>)<sub>0.07</sub>. The electrode-grid configuration was an improved version of several configurations explored to date, consisting of a thin layer of platinum paste overlaid with a fine platinum mesh and reinforced with 0.05-cm gold alloy wire. The cells were connected electrically in series, and the gas flow to the cells was in parallel. Improved assembly and leak testing procedures were also employed in this module.

Z.W.

**A71-36376 #** General Electric Company solid polymer electrolyte water electrolysis system. L. J. Nuttall and W. A. Fitterington (General Electric Co., Aircraft Equipment Div., Lynn, Mass.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-9*. 11 p. Members, \$1.00; nonmembers, \$3.00.

The General Electric Company has demonstrated more than 250 days of efficient troublefree operation on a new type of water electrolysis stack which uses a solid sheet of sulfonated perfluoro linear polymer as the sole electrolyte material. Two one-man electrolysis stacks have been life tested under a NASA/LRC contract over a wide range of operating temperatures and current densities,

demonstrating - in addition to long operating life capability - excellent cycle life, high efficiency, and a high degree of tolerance to abnormal operating conditions. A 4-man and 12-man system design study was completed and a one-man breadboard system is presently being assembled for test evaluation.

(Author)

**A71-36377 \* #** Advanced regenerative portable life support system for extravehicular activity. A. B. Chambers (NASA, Ames Research Center, Moffett Field, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-10*. 6 p. Members, \$1.00; nonmembers, \$3.00.

Manned space programs in the late 1970s and 1980s may require longer duration and multiple extravehicular activity (EVA). The use of expendables for life support, as required by the current Apollo portable life support system (PLSS), may be prohibitively expensive and burdensome. For future EVA's to be effective in the total mission context the PLSS may require a regenerable capability. This paper outlines a four-phase program, the advanced extravehicular protective system (AEPS) Study, for the development of a regenerable EVA life support system. The first phase, AERS concepts analysis, is described with the results detailed.

(Author)

**A71-36378 \* #** Water reclamation from urine by electrolysis-electrodialysis. D. F. Putnam and R. L. Vaughan (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-11*. 20 p. 13 refs. Members, \$1.00; nonmembers, \$3.00. Contract No. NAS 1-8954.

Urine can be converted to potable water in a two-step electrolysis-electrodialysis process. In the first step, organic solutes are removed by urine electrolysis and the resulting semipurified urine contains primarily inorganic salts. In the second step, these residual inorganic salts are removed by electrodialysis. A 6-man flight concept breadboard unit is described, which is completely automated, self-sterilizing and can continuously process urine at a 12-man rate. Photographs are included of the unit and components, a mass and energy balance, a discussion of the electrochemistry of the process, and a description of the principal components including the urine electrolysis cell, electrodialysis stack, and zero-g bladder tanks. Results of around-the-clock testing of the breadboard unit are also given.

(Author)

**A71-36379 #** Life-support system design for a 12-man solar-array space station. G. E. Laubach and G. C. Schaedle (North American Rockwell Corp., Space Div., Downey, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-12*. 21 p. Members, \$1.00; nonmembers, \$3.00.

Description of a preliminary design of an environmental control and life-support subsystem (ECLSS) for a 12-man, 10-year mission capability with 180-day resupply. The design is based on a 1976 launch and utilizes a solar-array/battery electrical power supply. The Sabatier process is incorporated for reclamation of oxygen from carbon dioxide, and a vapor compression/reverse osmosis concept is used for waste water reclamation. The ECLSS features integrated subcritical cryogenic storage with the reaction control subsystem and operation synchronized to the orbit light side to obtain electrical power at minimum penalty. Major design requirements include (1) a capability of operating as a utility service and accommodating a versatile research and experiment program, (2) an interface with the information system for automatic fault isolation, checkout, and



control, and (3) provisions for increased crew habitability in terms of water supply, noise, ease of maintenance, comfortable personal-hygiene and waste-management facilities, and food management.

T.M.

**A71-36380 \* # Space station life support system definition.** J. C. Cody (NASA, Marshall Space Flight Center, Huntsville, Ala.), R. M. Byke, and W. G. Nelson (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-13.* 12 p. Members, \$1.00; nonmembers, \$3.00.

Description of methods developed for the selection and definition of an environmental control and life support subsystem (ECLSS) to be used in a 12-man space station. The objective of this phase of activity is to define a preliminary design that will require minimum resources to develop it in time to qualify for supporting a 1978 launch. The selected ECLSS is a partially closed system capable of regenerating the cabin atmosphere and reclaiming the waste water. Additional functions include atmosphere contaminant and pressure control, atmosphere distribution and ventilation, and food and waste management control. During the definition study, it became apparent that integration of the ECLSS, the orbit-keeping bio waste resistojet propulsion system, and the isotope-Brayton power system provided an optimum approach for satisfying the space station requirements.

T.M.

**A71-36381 \* # Skylab environmental control and life support systems.** G. D. Hopson, J. W. Littles, and W. C. Patterson (NASA, Marshall Space Flight Center, Propulsion and Thermodynamics Div., Huntsville, Ala.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-14.* 19 p. Members, \$1.00; nonmembers, \$3.00.

Skylab, which is the first United States orbiting space station, will be launched in early 1973. Initially, a three-man crew will perform orbital experiments during a 28-day mission. Subsequently, there will be two revisits, each 56 days' duration. This paper briefly describes the Skylab configuration and mission, and emphasizes the design and predicted performance of the environmental and life support systems, including thermal and humidity control, carbon dioxide removal, atmosphere supply, and water and waste management systems.

(Author)

**A71-36382 \* # Space Shuttle Orbiter Environmental Control and Life Support Systems.** O. T. Stoll (North American Rockwell Corp., Space Div., Downey, Calif.) and B. B. Turner (American Airlines, Inc., Tulsa, Okla.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-15.* 8 p. Members, \$1.00; nonmembers, \$3.00. NASA-supported research.

The Environmental Control and Life Support Subsystems are presented for the Space Shuttle-Orbiter. This paper reflects a summary of work completed by the North American Rockwell Space Division team, under contract to NASA's Manned Spacecraft Center. American Airlines is a member of this team. System description and installation criteria, in accordance with airline maintenance practices, are stressed. The system is based primarily on 1972 technology, low cost, and with operational capability planned for 1977.

(Author)

**A71-36383 # Space Shuttle Environmental Control and Life Support System.** W. Herrala and G. N. Kleiner (United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn.). *American*

*Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-16.* 11 p. Members, \$1.00; nonmembers, \$3.00.

A space shuttle system has been identified by the NASA as a requirement in future operations for economically transporting cargo and personnel into space. Such a vehicle will be required to support a variety of payload types and mission conditions. It is important, therefore, that the shuttle be an extremely versatile vehicle to support the multi-purpose goals defined for it. The operation of the Environmental Control and Life Support System (EC/LSS) can provide meaningful contribution to the desired flexibility of the shuttle vehicle. The design of the EC/LSS is envisioned as a system level concept optimization with a vast number of options requiring consideration and evaluation. Hamilton Standard, in concert with the NASA Langley Research Center, has conducted a series of trade studies to determine the shuttle orbiter EC/LSS configuration. This paper reports on some of these trade studies, presents conclusions, and documents supporting rationale.

(Author)

**A71-36384 \* # Analysis of trace contaminants.** P. P. Mader, A. S. Lucero, and E. P. Honorof (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-17.* 9 p. Members, \$1.00; nonmembers, \$3.00. Research supported by the McDonnell Douglas Astronautics Independent Research and Development Program; Contract No. NAS 1-8997.

During the 90-day operation of the Space Station Simulator (SSS) and the short-duration manned and unmanned test runs which preceded it, analytical support was provided by determining the composition and daily fluctuations of trace contaminants. A daily search was instituted in which air samples were withdrawn from the SSS and analyzed. Sampling and analytical procedures depended on whether the tests pertained to inorganic or organic compounds. The inorganic contaminants such as ammonia, sulfur dioxide, oxides of nitrogen, and aldehydes were determined by conventional wet chemical analyses, while organic compounds were analyzed by gas chromatography, after previous calibration of two instruments for approximately 120 compounds. Particular attention was directed to specific compounds which have been reviewed and to which pretest planning had assigned contingency and abort levels. Many of these levels were established upon the recommendation of the Panel of Air Standards for Manned Space Flights of the National Academy of Sciences.

(Author)

**A71-36385 \* # Oxygen recovery for the 90-day Space Station simulator test.** E. S. Mills, T. J. Linzey, and J. F. Harkee (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-18.* 14 p. Members, \$1.00; nonmembers, \$3.00. Contract No. NAS 1-8997.

The following elements of the oxygen recovery subsystem are discussed: (1) carbon dioxide removal by solid amine or molecular sieve units, (2) carbon dioxide reduction by the Sabatier reaction, and (3) water electrolysis for oxygen regeneration by the static vapor feed or circulating electrolyte units. The solid amine unit was used for CO<sub>2</sub> control during the majority of the first 81 days of the test. The molecular sieve unit operated approximately 22 days during the total 90-day test. The Sabatier unit converted the CO<sub>2</sub> concentrated by the atmosphere purification equipment into water and methane. The methane was discharged overboard and the water was electrolyzed to hydrogen and oxygen. The unit produced about 350 lb of water during the test. Three different water electrolysis units were

used. A commercial unit was used for backup to the two experimental units. All units experienced failures during the test. The program described shows that additional development and testing of water electrolysis is needed. Z.W.

**A71-36386 #** Design of a spacecraft contaminant control system. T. M. Olcott (Lockheed Missiles and Space Co., Sunnyvale, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-19.* 16 p. Members, \$1.00; nonmembers, \$3.00.

Contaminant control on manned spacecraft becomes increasingly more important as crew sizes and mission durations increase. Larger crew sizes involve a wider variety of equipment and hence a greater number of potential contaminants. Longer mission durations bring about a reduction in the allowable contaminant concentrations. Control of a large number of contaminants requires a system involving many elements. Candidate removal concepts include catalytic, oxidation, chemisorption and charcoal adsorption. Charcoal adsorption can be accomplished utilizing either regenerative or nonregenerative techniques. The paper describes a system design integrating these various elements and including the design methodology and the results of a computer program utilized to predict the performance of charcoal beds. The results of long-term design verification testing with a model system are also presented. (Author)

**A71-36387 #** Status of the LMSC circulating electrolyte water electrolysis system. B. M. Greenough (Lockheed Missiles and Space Co., Sunnyvale, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-20.* 13 p. 6 refs. Members, \$1.00; nonmembers, \$3.00.

Development of a zero-gravity water electrolysis system to provide metabolic and leakage makeup oxygen is a pacing item in achieving the objective of regenerative life support system flight hardware. The several technical problems generic to adapting the water electrolysis process to zero-gravity operation are discussed and the circulating electrolyte approach to solving these problems is presented. Development results and present status of a program of development of the circulating-electrolyte electrolysis concept are discussed. The preliminary design of a 12-man flight prototype system of this type is presented. (Author)

**A71-36388 \* #** Electrochemical carbon dioxide concentrating system. R. A. Wynveen (Life Systems, Inc., Cleveland, Ohio) and P. D. Quattrone (NASA, Ames Research Center, Moffett Field, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-21.* 17 p. 14 refs. Members, \$1.00; nonmembers, \$3.00.

Six years of development and 100,000 cell operating hours on the electrochemical CO<sub>2</sub> concentrator are reviewed. This includes a description of cell reactions, cell design, three different 1-man-module designs, four different systems, and testing. The latter includes programs on parametric, cyclic (startup, operate, shutdown), endurance, animal- and man-in-the-loop, and environmental tests. Parametric test results on the effect of temperature, CO<sub>2</sub> and O<sub>2</sub> partial pressures, flowrates and current density are discussed in terms of CO<sub>2</sub> removal and electrical efficiencies. The paper includes discussion of a self-contained system for spacecraft application. The incorporation of a second generation trend analysis and fault isolation capability into the hardware is briefly reviewed. (Author)

**A71-36389 \* #** System features of a space station prototype environmental thermal control and life support system. N. C. Willis, Jr., F. H. Samonski, Jr. (NASA, Manned Spacecraft Center, Crew Systems Div., Houston, Tex.), Charles Flugel, and Paul Tremblay (United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-22.* 7 p. 5 refs. Members, \$1.00; nonmembers, \$3.00.

The preliminary design phase of the space station prototype environmental thermal control and life support system program has been completed, and the detailed design of the system is underway. This paper describes some of the specific system features which have been incorporated to solve the problems of maintainability, to ensure reliability without excessive weight penalties, and to achieve fault detection and isolation through use of the capabilities of an onboard checkout system. (Author)

**A71-36390 #** Thermal design and evaluation of the ITOS-1 spacecraft. R. R. Scott (RCA, Astro-Electronics Div., Princeton, N.J.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-23.* 17 p. Members, \$1.00; nonmembers, \$3.00. ESSA-supported research.

Launch of the ITOS-1 (Improved Tiros Operational System) spacecraft on Jan. 23, 1970, inaugurated the second decade of the Operational Meteorological Satellite Program. The spacecraft thermal design provides essentially fail-safe temperature regulation for widely varying operating conditions, and is insensitive to orbit environment radiation degradation. The thermal design and analysis is described, with predicted performance compared to measured test and orbital flight data. (Author)

**A71-36391 \* #** Development status of the water vapor electrolysis system. V. A. Celino (United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn.) and Theodore Wydeven (NASA, Ames Research Center, Moffett Field, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-24.* 10 p. 10 refs. Members, \$1.00; nonmembers, \$3.00.

This paper presents the development status of the water vapor electrolysis concept for oxygen generation and supplemental humidity control in long term manned spaceflight. A prototype system capable of producing sufficient oxygen (2 lb/day) for one man is described with performance during 2000 hr of testing. Future design modifications required for flight systems are presented with weight, power, and volume projections based on incorporation of a new electrode which has become available since the prototype systems. Present cell performance is 32 amp/sq ft at 2.12 v; the new electrode can increase this to 64 amp/sq ft at 1.76 v across the cell. This will reduce the number of cells by 50 per cent and the power by 17 per cent. (Author)

**A71-36392 #** Status of the life systems' static feed water electrolysis system. F. H. Schubert (Life Systems, Inc., Cleveland, Ohio). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-25.* 15 p. 12 refs. Members, \$1.00; nonmembers, \$3.00.

The system described employs a concentrated potassium hydroxide solution as the electrolyte held in a porous asbestos

matrix. The control used to match oxygen generation rate with use rate is discussed. The performance of the system is reviewed, including the effect of current density, operating time, and temperature on voltage for various electrochemical cell sizes. The ability to operate without degassing is examined. The anode contributes 89% to the increase in cell voltage above the theoretical value initially. All materials of construction demonstrated satisfactory operation for more than 400 days, but improvements can be made at the anode. The differences between the system described and past spacecraft-oriented versions are discussed. Z.W.

**A71-36393 \* #** Experimental high performance heat pipes for the OAO-C spacecraft. Walter Bienert and Edward Krolczek (Dynatherm Corp., Cockeysville, Md.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-26*. 11 p. 6 refs. Members, \$1.00; nonmembers, \$3.00. Contract No. NAS 5-11271.

Two circular heat pipes with an arterial wick were developed, featuring a high-heat transport capability combined with insensitivity to gravity and low overall thermal resistance. They will have a dual function on the spacecraft - i.e., to isothermize its structure and to evaluate arterial heat pipes in a flight experiment. The heat pipes were laboratory tested in both the arterial and conventional mode, and all performance criteria were met. Some difficulties were encountered, however, in reliably priming the artery under all conditions in the laboratory. In parallel with the development of the flight hardware, pressure qualification tests of aluminum-ammonia heat pipe samples were conducted, and a 3000-hr life test was completed. Z.W.

**A71-36394 \* #** Transient performance of electrical feedback-controlled variable-conductance heat pipes. Walter B. Bienert and Patrick J. Brennan (Dynatherm Corp., Cockeysville, Md.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-27*. 9 p. Members, \$1.00; nonmembers, \$3.00. Contract No. NAS 2-6227.

The authors investigated the effects of various system parameters on the transient response of a heat source whose temperature is regulated by an electrical feedback-controlled variable-conductance heat pipe. A closed-form analytic solution which can be used to evaluate the transient performance and provide preliminary design data is presented. Results obtained with an experimental model of an electrical feedback-controlled heat pipe are discussed and correlated using the closed-form solution. An optimum design of such a system depends on a trade-off between steady-state and transient considerations. (Author)

**A71-36395 #** Thermal control of ATS F and G. Robert J. Eby, William H. Kelly, and Robert D. Karam (Fairchild Hiller Corp., Space and Electronics Systems Div., Germantown, Md.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-28*. 14 p. 10 refs. Members, \$1.00; nonmembers, \$3.00.

This paper presents Applications Technology Satellite (ATS) F and G thermal requirements, design, and analysis. The analysis may be broken down into three general categories: heat pipe, louver, and system. The heat-pipe analysis includes design equations and curves, generated to determine optimum design, and culminates in a heat-transport capability vs transport-distance curve. The louver analysis outlines methods used to determine louver heat-rejection

capability for various operating modes, orbital conditions, and solar heat inputs. A multinode thermal model that is described was used to obtain detailed temperature maps for structure and components.

(Author)

**A71-36396 #** Characteristics of six novel heat pipes for thermal control applications. A. Basiulis and M. Filler (Hughes Aircraft Co., Torrance, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-29*. 9 p. 9 refs. Members, \$1.00; nonmembers, \$3.00.

Description of the test results and design rationale for choosing the specific configurations of heat pipes developed for certain thermal control applications. The liquid-nitrogen working fluid heat pipe operated at 7.9 W/sq cm with its evaporator end elevated and could be stored safely at room temperature. A circuit-board heat pipe operated from -50 to +80 C with a maximum evaporator to condenser differential temperature of less than 10 C. The heat switching device could transfer a preset finite amount of heat at a predetermined temperature, and the flexible heat pipe could be operated in an infinite variety of shapes, including being tied into a knot. The transformer heat pipe, used to control the temperature of the windings of a high power density pulse transformer, had an electrical insulating center section. The controlled temperature heat pipe, which used multievaporator segments, was developed for dissipation of 25 to 175 W at a temperature of -6 to +3 C. Z.W.

**A71-36397 \* #** Spaceborne passive radiators for detector cooling. R. Merriam and F. Gabron (Arthur D. Little, Inc., Cambridge, Mass.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-30*. 11 p. 6 refs. Members, \$1.00; nonmembers, \$3.00. Contract No. NAS 5-21009.

The authors describe a study of requirements for detector cooling techniques by means of passive radiation coolers for spacecraft in geosynchronous orbit. The methodology of shielding by specularly reflecting surfaces is reviewed, and the geometric construction of the cooler in relation to the spacecraft configuration is examined. Detailed transient calculations are described for a typical radiation cooler designed for a spacecraft configuration. Temperatures are predicted as a function of orbital position for three different times of the year - summer solstice, equinox, and winter solstice. The influence of uncertainties or changes in design parameters on cold-stage temperature is described, as is a method of evaluating the importance of these uncertainties. (Author)

**A71-36398 #** Development of a prototype vapor diffusion water reclamation system. William A. Blecher (United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-31*. 7 p. Members, \$1.00; nonmembers, \$3.00.

The vapor diffusion reclamation process described uses the principles of distillation to produce pure and sterile water from a urine process stream. The central part of the system is an assembly consisting of evaporator and condenser modules. The evaporator module uses a semipermeable polyvinyl chloride membrane to separate circulating urine from a nitrogen gap between the membrane and the condenser module. The urine is pretreated with sulfuric acid and chromium trioxide to prevent formation of ammonia and to inhibit microbial growth. Urine enters the evaporator module at a

maximum temperature of 150 C. The membrane, while not permitting liquid transfer, is permeable to the water vapor. The condenser module is kept at a temperature of 50 F. Because of the vapor pressure across the gap between the evaporator membrane and the condenser surface, water vapor travels by diffusion from one to another. The membrane provides the necessary bacterial barrier between urine and product water. The practicability of this system was demonstrated over a 90-day test period. Z.W.

**A71-36399 \* #** 180-day life test of solid electrolyte system for oxygen regeneration. L. Elikan, J. P. Morris, C. K. Wu (Westinghouse Research Laboratories, Pittsburgh, Pa.), and C. G. Saunders (NASA, Langley Research Center, Hampton, Va.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-32.* 12 p. 5 refs. Members, \$1.00; nonmembers, \$3.00.

A closed-loop solid electrolyte oxygen regeneration system, successfully life tested for 180 days, had an electrolyzer, a carbon reactor, six palladium hydrogen-separating membranes, and a recycle pump as the operating units. Oxygen recovery from the CO<sub>2</sub>-water vapor feed was 95.1 per cent but only one-fourth of the unrecovered oxygen would have been lost in a real system. Electrolysis power increased 20 per cent during test, the average being 283.5 w/man. Crew time was 18 min/day, of which 12 min was used for carbon removal. Of 42 electrolysis cells operated the full 180 days, none failed. Stability of operation, ease of control, and flexibility in feed composition were demonstrated. (Author)

**A71-36400 #** Three-day mission Biosatellite thermal control system design and flight performance. Robert Ebersole (General Electric Co., Re-Entry and Environmental Systems Div., Philadelphia, Pa.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-33.* 11 p. Members, \$1.00; nonmembers, \$3.00.

Description of a semipassive environment control system for biological experiments on Biosatellite spacecraft in two three-day missions. The system is divided into four functional areas involving capsule pressure control, air circulation and humidity control, temperature control, and telemetry instrumentation. Flight data obtained in two missions from 64 on-board sensors (showing a continuous orbit temperature history of the biological experiments and vehicle components) demonstrate that a precision-controlled capsule environment for biological space investigations can be attained with simple standard passive and semipassive design techniques. Use of thermal coatings, insulation, and heaters resulted in a high degree of temperature control (plus or minus 2 deg F). Excellent capsule relative humidity and pressure control were also achieved. T.M.

**A71-36401 #** Computer simulation of the environmental thermal control and life-support system for the space station prototype. R. B. Trusch, E. W. O'Connor, W. J. Ayotte (United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn.), and R. S. Barker (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-34.* 13 p. Members, \$1.00; nonmembers, \$3.00.

The authors discuss analytical modeling features of the simulation from the viewpoints of (1) overall system performance

prediction capability and (2) detail modeling of thermodynamic, hydrodynamic, and chemical reaction processes for subsystem components. Transient design and off-design system performance predictions are related to the importance of transient subsystem and component characteristics in influencing the control of major system variables, which include cabin temperature, CO<sub>2</sub> level, and humidity. Also discussed are the interactions of controllers with subsystems in achieving control of the variable quantities, as well as heat transport fluid temperatures at key locations. (Author)

**A71-36402 \* #** Suitability of metalized FEP teflon as a spacecraft thermal control surface. James B. Heaney (NASA, Goddard Space Flight Center, Greenbelt, Md.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-35.* 8 p. 17 refs. Members, \$1.00; nonmembers, \$3.00.

Optical measurements performed on teflon films of various thicknesses - and coated with evaporated Ag, Al, or Au - demonstrate the dependence of the solar absorptance and emittance (300 K) on the teflon film thickness and the reflectance of the metal underlayer. A correlation between the type of metal used as the reflective coating and the rate and magnitude of observed irradiation-induced degradation is also presented. The correlation shows that Ag-coated teflon films are less sensitive to damage than aluminized films. Flight data currently available indicate that metalized teflon films are generally more stable than white paints in space environment although a definitive comparison will not be made until the OSO-H spacecraft is launched in the summer of 1971. Laboratory temperature cycling tests have revealed that double-sided pressure-sensitive adhesive tape is the most reliable bonding agent for surfaces in the temperature range +50 C to -150 C. Problems associated with cleaning and handling teflon coated surfaces are also discussed. (Author)

**A71-36403 \* #** Thermal control systems design for space station. M. N. Tawil and A. A. Ferrara (Grumman Aerospace Corp., Bethpage, N.Y.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-36.* 20 p. 8 refs. Members, \$1.00; nonmembers, \$3.00. Contract No. NAS 9-10436.

An investigation, made to formulate and evaluate alternative concepts for space station thermal control systems, resulted in two advanced systems being designed and compared to the present pumped loop system. The advanced concepts are the air-cooled semipassive system, which features rejection of a large percentage of the load through the outer skin, and the heat pipe system, which incorporates heat pipes for every thermal control function. Both advanced systems show significant weight and power consumption advantage over the state-of-the-art pumped loop system. Thermal analyses demonstrated that all of the systems were capable of meeting the performance requirements under all design conditions. The design details presented in this paper demonstrate that advanced system hardware may be used to realize a potential 30 per cent weight savings over present techniques. (Author)

**A71-36404 \* #** Hydrogen depolarized cell for a CO<sub>2</sub> concentrator. Harlan F. Brose (United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-37.* 8 p. Members, \$1.00; nonmembers, \$3.00. Contract No. NAS 9-10273.

Carbon dioxide (CO<sub>2</sub>) concentrator research has been oriented toward concepts minimizing moving parts and applicable to modular construction. The hydrogen depolarized cell is such a device. The unit utilizes the energy of a fuel cell reaction to pump CO<sub>2</sub> from a low partial pressure at the cathode (air side) to a high partial pressure at the anode (hydrogen side). The process is continuous and is capable of operating efficiently at a cabin CO<sub>2</sub> partial pressure of 1 mm Hg. Hamilton Standard has been conducting prototype cell testing, for the NASA Manned Spacecraft Center in support of the space station prototype (SSP). This paper describes the hydrogen depolarized cell CO<sub>2</sub> concentrator and summarizes the test results obtained from the SSP effort. (Author)

**A71-36405 \* #** Overview of a 90-day manned test in a space station simulator. J. K. Jackson, J. R. Wamsley, and J. S. Seeman (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-38.* 15 p. 10 refs. Members, \$1.00; nonmembers, \$3.00. Research supported by the McDonnell Douglas Astronautics Independent Research and Development Program; Contract No. NAS 1-8997.

A 90-day manned test of a regenerative life-support system in a space station simulator (SSS) was recently completed. This overview of the program includes test objectives, a description of the facilities and procedures that were used, and a review of the life-support subsystems that were evaluated during the test. (Author)

**A71-36406 #** Frictionless bimetal-actuated louver system. R. J. Williams (RCA, Astro-Electronics Div., Princeton, N.J.). *American Society of Mechanical Engineers, Society of Automotive Engineers, and American Institute of Aeronautics and Astronautics, Life Support and Environmental Control Conference, San Francisco, Calif., July 12-14, 1971, ASME Paper 71-Av-39.* 5 p. Members, \$1.00; nonmembers, \$3.00.

This paper describes the physical and thermal characteristics of a unique frictionless bimetal-actuated louver system used for spacecraft thermal control. The frictionless characteristic is obtained by using a spiral-wound bimetal element to support and actuate an ultra-lightweight louver. The ultra-lightweight louver is an open cell foam sandwich structure. The louver system exhibits an unusually high open-blade louver transmissibility ratio (LTR) of approximately 0.96. LTR is defined as the ratio of net radiation heat transfer through the louver control area to the net radiation heat transfer for an identical system without louvers. The closed louver LTR is approximately 0.19. The results of vibration and thermal testing are presented and discussed. (Author)

**A71-36627 \* #** A proposed experimental program for determining the requirements for artificial gravity. J. Billingham (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-871.* 10 p. 84 refs. Members, \$1.50; nonmembers, \$2.00.

The creation of artificial gravity by space vehicle rotation would ameliorate some of the changes in the cardiovascular, fluid balance and musculoskeletal systems thought to occur in weightlessness. It should, in theory, also prevent the appearance of agravic sensory disjunction (Graybiel's syndrome). If further experience of long-duration exposure of man to weightlessness indicates that artificial gravity is desirable, it becomes important to know what the design specifications for a rotating vehicle should be. The problem is complicated by appearance of motion sickness and all its side effects as a result of Coriolis forces if the angular velocity is too high. Final

design represents a trade off between angular velocity and g level, considered from physiological, habitability, and engineering aspects. The first vehicle to employ artificial gravity should be designed in such a way that experiments can be carried out to give information about future design figures. Ideally, such a vehicle would be sufficiently flexible to examine ranges of angular velocities and radii, between the long-radius, low-angular velocity condition giving little problem from motion sickness, and the short-radius, high-angular velocity case, where physiological tolerances to the spin rate would be examined. (Author)

**A71-36628 #** Skylab habitability evolution. W. H. Hanlon, D. E. Havens, and R. E. Snyder (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-872.* 8 p. Members, \$1.50; nonmembers, \$2.00.

Discussion of the effects of habitability considerations on the design of the Orbital Workshop. The design evolution of the areas examined are the waste management compartment (WMC), the wardrobe, and the sleeping compartment. The habitability of the Workshop has improved as the program evolved. From the initial wet Workshop through development of possible modifications to extend use of the backup hardware, the total effect of any group of changes has resulted in a more usable Workshop for the crewmen. F.R.L.

**A71-36629 \* #** Space shower habitability technology. Arthur A. Rosener, Duane M. Parker, Scott C. Harris (Martin Marietta Corp., Denver, Colo.), and John B. Hall, Jr. (NASA, Langley Research Center, Hampton, Va.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-873.* 9 p. Members, \$1.50; nonmembers, \$2.00. Contract No. NAS 1-9819.

Discussion of means of effecting adequate cleansing of the body and hair on long space missions to satisfy the physiological, psychological, and social needs of crew members on long space missions. A zero-gravity, whole-body shower design is described which provides bathing facilities similar to those used on the earth. In the absence of gravity surface tension is the primary force which governs water behavior. Shower stalls and associated hardware must be designed to effectively collect water for subsequent processing. The shower habitability parameters must be integrated with this technology to ensure crew compatibility and comfort. F.R.L.

**A71-36630 #** Garment system considerations for Skylab and space station. Austin C. Morris (Welson and Co., Inc., Hartford, Conn.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-875.* 6 p. Members, \$1.50; nonmembers, \$2.00.

Description of several of the garment items to be worn by Skylab and space station crew members. The system aspects of the total wardrobe, its impact upon vehicle design, and potential problems in future missions are discussed. The basic garment consists of the jacket, trousers, and a knit shirt. The selection of clothing and personal items is, at best, a subjective task. As such, the unique aspects of personal preference and style must be integrated with function and overall system impact. The definition of garment systems and accessories will have a greater importance and prominence in the overall planning of mission objectives in the future. F.R.L.

**A71-36631 #** Crew personal hygiene for long-term flight. Anthony J. Giotta (Fairchild Hiller Corp., Republic Aviation Div.,

Farmingdale, N.Y.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-878*. 7 p. Members, \$1.50; nonmembers, \$2.00.

Personal cleaning, personal grooming and the management of human wastes are discussed. The present status of spacecraft personal hygiene equipment, including developed experimental and proposed concepts, is reviewed. Some task areas associated with providing the required spacecraft habitable environment are identified. For prolonged space flights, the fact that systems must be psychologically acceptable to the crew as well as technically superior to existing system is stressed. Human waste collection methods, processing and/or utilization methods for wastes, need of microbiological control, and the requirement for some type of medical infirmary/dispensary/laboratory and biomedical monitoring are considered.

(Author)

**A71-36632 \* # \*** **Architecture and environment - Basic tools of habitability in space system design.** Gordon Rysavy and Clarence D. Council (NASA, Manned Spacecraft Center, Houston, Tex.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-879*. 10 p. Members, \$1.50; nonmembers, \$2.00.

Consideration of habitability as a factor in enabling man to live and work in space for extended periods. The base line for considering man as an integral element within the complex structure of space systems is accomplished with criteria definition and three-dimensional design techniques. From three-dimensional designs of the habitability elements and subsequent analyses, several positive design requirements have been formulated. These design requirements include separation of the work area from the living area, provisions for private but not isolated staterooms, and enclosed hygienic facilities adjacent to staterooms and wardroom areas. F.R.L.

**A71-36633 #** **Housekeeping systems for manned space systems.** Peter H. Needham (Fairchild Hiller Corp., Republic Aviation Div., Farmingdale, N.Y.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-880*. 10 p. Members, \$1.50; nonmembers, \$2.00.

Housekeeping systems for the modular space station and the shuttle are described. They include those for steward duties, cleaning and waste control. Waste control includes waste collection, sorting, transfer, pretreatment, storage, utilization and disposal. Equipment and procedures are related to the waste sources, characteristics, generation rates and destinations. They are dependent on the number of crew members, the experiments and missions, and the spacecraft configuration and systems. Transfer and stowage are similar for incoming and waste materials. Waste utilization reduces both up and down cargo requirements. Computerized techniques for data storage, search and correlation of material and housekeeping characteristics are desirable.

(Author)

**A71-36634 #** **Afferent mechanisms responsible for the orthostasis of space flight.** J. P. Meehan and L. W. Chapman (Southern California, University, Los Angeles, Calif.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-883*. 5 p. 12 refs. Members, \$1.50; nonmembers, \$2.00.

Consideration of the two basic physiological phenomena involved in the orthostasis encountered in the weightless state. The first concerns the observed reduction of plasma fluid volume, and the second involves the dynamic cardiovascular adjustments seen on passive tilting. The afferent inputs for these regulatory mechanisms consist of specialized nervous receptors located in the subendocardial

layers of the atria and the ventricles. Although this particular location has made their physiologic investigation difficult, they have been shown to play a key role in the fluid volume changes encountered in weightlessness and in the cardiovascular adjustments to passive tilting.

F.R.L.

**A71-36635 \* #** **Stimulus generalization of gravity produced by variations in angular velocity and radius.** D. F. McCoy, Craig T. Love, and Dianne B. Miller (Kentucky, University, Lexington, Ky.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-884*. 7 p. 7 refs. Members, \$1.50; nonmembers, \$2.00. Grant No. NGR-18-001-046.

Extension and clarification of earlier research performed using the stimulus generalization procedure to explore and delineate the degree to which gravitational stimuli can function as do other stimuli in the control of behavior. Extension and clarification are made by separating angular velocity and resultant force, g, at the behavioral level, in two experiments. It is pointed out that, when artificial gravity and rotation are separated experimentally, the data obtained offer strong support for the contention that the controlling stimulus in these and other similar experiments is artificial gravity and not rotation. The fact that similar results were obtained with different species of animal and under different experimental procedures further underscores this conclusion.

M.M.

**A71-36636 \* #** **Some aspects of locomotion and cargo handling in simulated artificial gravity.** James A. Green (North American Rockwell Corp., Space Div., Downey, Calif.), William M. Piland, and Ralph W. Stone, Jr. (NASA, Langley Research Center, Hampton, Va.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-886*. 10 p. 17 refs. Members, \$1.50; nonmembers, \$2.00. Contract No. NAS 1-9711.

Evaluation of man's ability to perform gross and fine psychomotor activities in a simulated artificial 'g' environment. Gross locomotion, including both radial and tangential crew locomotion, was evaluated at rotational rates of 3, 4 and 5 rpm. The results indicated that the simulated artificial 'g' conditions were not unduly stressful on the test subjects. The 'elevator ride' was found to be without disquieting vestibular stimuli but relatively pleasant at all speeds. However, at translational rates greater than 6 ft/sec, some crew restraint may be necessary to counteract lateral Coriolis forces in the presence of diminishing centrifugal forces. Ladder climbing was found to be an acceptable mode of radial locomotion, with no strong subjective preference for facing either the prospin or antispin orientation. Tangential locomotion and cargo transport in the movable enclosure were found to be subjectively better when facing the prospin direction as compared to walking in the antispin direction.

M.M.

**A71-36637 \* #** **Initial assessment of various human behavior capabilities in a rotating environment.** James L. Peacock and James A. Green (North American Rockwell Corp., Space Div., Downey, Calif.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-888*. 11 p. Members, \$1.50; nonmembers, \$2.00. Contract No. NAS 1-9711.

Human performance while rotating was evaluated during various duration test runs. Behavioral tests utilized included the Stromberg Dexterity, pursuit rotor, mental arithmetic, verbal learning, and the NAMI Ataxia test. The factors evaluated included rotation rates, orientation to the direction of rotation, time of day (fatigue), the affects of patterned head motions, and performance over time (adaptation). The results although in some cases inconclusive and

requiring further confirmation did indicate that all of these factors do influence performance. Also, it did support previous studies that concluded that humans can adapt and operate in a rotating environment. (Author)

**A71-36638 #** Influence of Coriolis forces on some design choices in rotating spacecraft. R. P. Haviland (General Electric Co., Valley Forge, Pa.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-889*. 4 p. Members, \$1.50; nonmembers, \$2.00.

Review of the physical principles involved, and derivation of an estimating graph relating the magnitude of the Coriolis force, the artificial 'g' level, the radius of rotation, rotational speed and velocity of motion. Common experience in situations where Coriolis forces arise, specifically on merry-go-rounds and ships at sea, is reviewed, and common adaptive measures are described. A set of axes is defined for such common expressions as up, down, fore, and aft, for spacecraft orientation, plus a set related to the body in motion. The physical forces and subjective results for motion along corridors, ramps, stairways and ladders are investigated. The force directions and magnitude for typical rates of motion for each of the possible orientations are considered. It is shown that corridor motion can have the illusion of walking on a ramp, and that ladder motion can have the illusion of climbing a canted or sloping ladder. M.M.

**A71-36639 \* #** Physiological responses to a rotating environment. A. Peter Holm, Louis J. Raggio, and James A. Green (North American Rockwell Corp., Downey, Calif.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-890*. 13 p. 24 refs. Members, \$1.50; nonmembers, \$2.00. Contract No. NAS 1-9711.

An evaluation of human performance in a rotating environment was conducted. Heart rates were chronically monitored on a daily basis, and blood pressure measurements were obtained before and after rotation in the one-day tests. Ergometry, orthostatic, and pulmonary function evaluations were performed before and after the seven-day test period. The long duration tests also included visual evaluations, using a Keystone Orthorater, and EEG measured during the evening sleep period. Comparative analysis of the data was performed with respect to orientation, radius, rotational rate and test duration. Analyses indicated a reduction in vital capacity, and overall physical work efficiency in response to the seven-day rotational exposure. G.R.

**A71-36640 \* #** Structural development of bone in the rat under earth gravity, hypergravity, and simulated weightlessness. John P. Jankovich (U.S. Navy, Naval Ammunition Depot, Crane, Ind.) and Karl O. Lange (Kentucky, University, Lexington, Ky.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-895*. 13 p. 45 refs. Members, \$1.50; nonmembers, \$2.00. Grant No. NGL-18-001-003.

The experimental results showed that at earth gravity normal aging takes place while physical dimensions, density, rigidity, microhardness, and ash content of bone increase; bone porosity and calcium content remain constant. Rats under hypergravity have smaller rates of growth than at 1g. The respective differences are due to differences in fatty tissue; bone development is unaffected by the gravitational environments. Immobilization significantly decreases bone density, ash and calcium content; immobilized bone becomes less porous and more brittle than bone of normal subjects. In the hypergravity range investigated, no significant and systematic changes were found; however, simulation of weightlessness was found to produce pronounced atrophy of bone. Thus it does not

seem possible to make simple extrapolations from the above-1g range to the below-1g range, since it is likely that there exists a threshold above which bone development is essentially normal while atrophy occurs below the threshold. M.M.

**A71-36641 \* #** An artificial gravity performance assessment experiment. Kenneth M. Mallory, Jr., N. E. Brown (Matrix Research Co., Huntsville, Ala.), and R. E. Allen (NASA, Marshall Space Flight Center, Huntsville, Ala.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-891*. 8 p. 8 refs. Members, \$1.50; nonmembers, \$2.00. Contract No. NAS 8-26558.

Description of a proposed flight experiment aimed at quantifying the effects of artificial-gravity and zero-gravity spacecraft environments on human performance. The qualification of performance assessment experiments for conduct during manned earth-orbital missions is discussed, and a concept for a crew performance data acquisition system is presented. OPT (Observational Performance Testing) has been selected as the primary data acquisition mode for early space shuttle flight experiments in crew performance in order to meet eight test selection criteria, leading to the adoption of the Bioengineering Test Administrator (BETA). The BETA centralizes functions common to all crew performance tests into a single, low cost, multipurpose system. M.M.

**A71-36642 \* #** Preliminary results of manned cargo transfer studies under simulated zero-g conditions. Amos A. Spady, Jr., Gary P. Beasley, and Kenneth R. Yenni (NASA, Langley Research Center, Hampton, Va.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-851*. 10 p. Members, \$1.50; nonmembers, \$2.00.

Examination of man's ability to perform intravehicular manual cargo transfer, using a water-immersion technique for zero-gravity simulation. The largest package tested, with a mass of 51 slugs, a moment of inertia about its center of mass of 285 slug/sq ft, and a volume of 142 cu ft was well within the subjects' cargo transfer capability. Therefore, no manual cargo transfer limits were established. The subjects could control and transfer all the packages tested using only a one-rail motion aid. However, a two-rail motion aid was definitely preferred for packages with moments of inertia about their center of mass greater than approximately 15 slug/sq ft. The maximum size package a man can transport in an intravehicular situation will probably be determined by the restraints of the space station. Two-man operation substantially reduces individual effort required for transferring large packages. (Author)

**A71-36643 #** Weightlessness as a key to orbital man-machine experimentation. H. L. Loats, Jr. and G. S. Mattingly (Environmental Research Associates, Essex, Md.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-850*. 9 p. Members, \$1.50; nonmembers, \$2.00.

Man-machine integration studies and simulations have been a key element in the space program since its inception. Most of this effort has necessarily been expended in support of existing or planned programs, and only a minor portion has been directed toward an understanding of human performance in weightlessness. Successful experimentation from the value standpoint, dollars spent versus value of data derived, requires that orbital experimentation primarily depend on gravity or gravity-associated phenomena. This paper offers a comparison of conventional human factors simulation techniques, a description of two candidate experiments which depends parametrically on weightlessness and variable gravity effects. (Author)

**A71-36644 \* #** Mathematical model analysis of underwater simulation of astronaut extravehicular activities in weightless conditions. Y. C. Pao (Nebraska, University, Lincoln, Neb.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-852*. 9 p. 8 refs. Members, \$1.50; nonmembers, \$2.00. Contract No. NAS 1-5875.

This paper presents the results of a theoretical research on underwater simulation of astronaut extravehicular activities in space. A scaling equation has been developed to interrelate the simulated environment and the actual space weightless conditions. In the development, it is assumed that damping effects of water on the underwater maneuvering subject constitute the difference between the two environments. To evaluate the additional energy consumed due to drag, a mathematical model composed of simple geometric shapes has been constructed to represent the suited subject. Based on segment-by-segment calculations, the drag energy equations in integral forms have been derived in terms of motion vectors at the joints of the body. Computer programs have been written to execute the entire scaling analysis by machine computation. The predictive metabolic rate of astronaut performing tasks in space will be the output of the program when the corresponding underwater metabolic rate and the motion histories are made available as inputs to the program. Limitations and feasibility of the present analysis are also discussed. To implement the method of analysis in this investigation, it is recommended that a Data Acquisition System be provided for generating digitized input data of underwater motions and that elaborated experiments for determining the drag coefficient  $C_{sub D}$  be conducted. (Author)

**A71-36645 \* #** Development of electroadhesive devices for zero-g intra/extravehicular activities. Gary P. Beasley and Walter W. Hankins (NASA, Langley Research Center, Hampton, Va.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-853*. 6 p. Members, \$1.50; nonmembers, \$2.00.

Discussion of methods that will allow the astronauts to maneuver or work anywhere inside or outside the spacecraft. One means of providing this capability uses chemically activated adhesive pads that can be placed where desired on the spacecraft's surface while in orbit. Although the use of these adhesives does alter the skin of the spacecraft, such devices can produce attachment forces of 400 psi or greater. Another method of effecting essentially unlimited maneuvering capability or worksite tiedown uses electroadhesive forces and offers a potential means of adhering to any conductive surface. Electroadhesors are being evaluated to determine the attachment force levels obtainable, the range of useful application, and the practical configurations of electroadhesive devices. Potential electroadhesor applications are discussed. M.M.

**A71-36646 \* #** Gravity selection by animals in fields of centrifugal acceleration superimposed on weightlessness during sounding rocket flights. K. O. Lange (Kentucky, University, Lexington, Ky.) and R. E. Belleville (NASA, Office of Life Sciences, Washington, D.C.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-854*. 9 p. 9 refs. Members, \$1.50; nonmembers, \$2.00. Grant No. NGL-18-001-003.

Results of four sounding rocket flight experiments in which rats were allowed to select their preferred level of artificial gravity by locomoting in runways forming a centrifuge with linearly increasing radii rotating at a constant angular velocity of 45 rpm during five minutes of free-fall trajectory. During two flights the desired gravity range of from 0.3 to 1.5 g at 45 rpm was achieved exactly, and a rather consistent pattern of locomotion emerged: all four animals moved over the entire available g-range, two starting from cages at

the highest available g, two from the lowest; one rat settled at 0.4 g after two minutes; the other three crossed and recrossed the 1 g location in progressively narrower excursions and were located close to the level of earth gravity at the end of the five-minute test period.

F.R.L.

**A71-36647 \* #** Avoidance behavior maintained by artificial gravity with variations in rotation rate and radius. Fogle C. Clark (North Carolina, University, Chapel Hill, N.C.), Karl O. Lange (Kentucky, University, Lexington, Ky.), and Richard E. Belleville (NASA, Office of Life Sciences, Washington, D.C.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-855*. 11 p. 14 refs. Members, \$1.50; nonmembers, \$2.00. Grant No. NGL-18-001-003.

Avoidance of increased artificial gravity from 1.05 to 2.55 g was studied in squirrel monkeys. Lever responses reduced centrifugally simulated gravity or postponed programmed increases. Manipulation of the interval by which responses postponed gravity increases had effects similar to those seen when avoidance behavior is maintained by electric shock. Similar patterns of avoidance responding were generated whether changes in artificial gravity were produced by varying rotation rate or radius. These experiments established the aversive character of increased effective weight whether produced by changes in angular velocity or radius. (Author)

**A71-36648 #** Modification of orthostatic tolerance with periodic lower body negative pressure. D. B. Cramer (U.S. Naval Aerospace Medical Research Laboratory, Pensacola, Fla.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-859*. 7 p. 24 refs. Members, \$1.50; nonmembers, \$2.00.

Returning astronauts have repeatedly displayed reduced orthostatic tolerance. Ground-based simulations of the weightless state such as water immersion and bed rest can reliably produce similar orthostatic intolerance. Using LBNP to measure orthostatic tolerance, evidence is presented demonstrating that brief, repeated exposure to LBNP is readily capable of restoring the loss of orthostatic tolerance resulting from bed rest and water immersion. In stimulating natural orthostatic mechanisms, periodic LBNP may represent a practical and efficacious method of managing orthostatic intolerance aloft without the use of artificial gravity. (Author)

**A71-36653 #** Engineering aspects of zero gravity personal hygiene and waste management systems. Robert W. Murray, John K. Mangialardi, and John D. Schelkopf (General Electric Co., Space Div., Philadelphia, Pa.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-865*. 20 p. Members, \$1.50; nonmembers, \$2.00.

One of the more difficult and perplexing problems of manned space flight are those related to personal hygiene and waste management in zero gravity. The long duration missions of Skylab and Space Station have necessitated new approaches which are presently under development at several government and industrial centers. Controlled air flows are used for the collection of wastes and for showering. Surface tension is used to store and position liquids. Artificial gravity is created by centrifuges to permit boiling of liquids and separation of solids, liquids and gases. New methods of testing systems have also been devised to permit concept evaluations in special laboratories or in specially equipped aircraft. Only the best concepts are then subjected to the more expensive tests in a space vehicle or if the earth-bound tests are conclusive enough, the concept



is directly prepared for space usage. For the first known time, an engineering over-view of the problems, solutions and test methods for zero gravity personal hygiene and waste management systems are presented. Pictorial results of neutral buoyancy, Keplerian trajectories in aircraft, negative one gravity and drop tower tests are shown along with the latest design concepts. The tests show the feasibility of providing more acceptable living conditions in space with vastly improved sanitary and crew safety facilities. (Author)

**A71-36654 \* #** Modelling human disorientation in a rotating spacecraft. Laurence R. Young (MIT, Cambridge, Mass.). *American Institute of Aeronautics and Astronautics and Aerospace Medical Association, Weightlessness and Artificial Gravity Meeting, Williamsburg, Va., Aug. 9-11, 1971, AIAA Paper 71-870*. 5 p. 9 refs. Members, \$1.50; nonmembers, \$2.00. Grants No. NGR-22-009-025; No. NGR-22-009-156.

The problem of disorientation in a rotating spacecraft is treated as an example of the general case of habituation to an unusual motion environment using all sensors and active movements. The dynamic response of the sensors is stressed. Several avenues for work on combatting disorientation are mentioned. (Author)

**A71-36687** Foveal perceptive fields in the human visual system measured with simultaneous contrast in grids and bars. Lothar Spillmann (MIT, Cambridge, Mass.). *Pflügers Archiv*, vol. 326, no. 4, 1971, p. 281-299. 65 refs. PHS Grant No. NB-05691.

Foveal perceptive fields (center plus surround) for human vision were investigated by means of contrast illusions in grids and bars. The task consisted of determining the size of the retinal area within which photic stimulation of the periphery induces apparent brightness changes of the central portions. The mean of the individual thresholds obtained in four experiments suggests a total field diameter of 17.8 min of arc (with an estimated 4.0 min corresponding to the center) for on- and off-center fields. It is assumed that this average value refers to perceptive fields of retinal ganglion cells. The significance of eye movements and after-images in contrast vision and their possible influence on these measurements is discussed. (Author)

**A71-36688** The afferent impulse traffic from atrial A-type receptors in cats - Does the A-type receptor signal heart rate. J. O. Arndt, P. Brambring, K. Hindorf, and M. Röhnelt (Berlin, Freie Universität, Berlin, West Germany). *Pflügers Archiv*, vol. 326, no. 4, 1971, p. 300-315. 42 refs. Research supported by the Deutsche Forschungsgemeinschaft; Contract No. AF 61(052)-68-C-0069.

The afferent nerve impulse traffic from 16 atrial A-type fibers (single units of the cervical vagus nerve) was studied in chloralosed spontaneously breathing cats. Analysis is based on the relationship between the number of impulses per burst, the average as well as the instantaneous frequency on the one hand, and the pressure level at the on-set of atrial contraction, the amplitude, and the slope of the atrial pressure curve during atrial contraction on the other. The number of impulses, the average, and the instantaneous impulse frequency were found to be remarkably constant in spite of large changes in atrial mechanics. Therefore the average discharge rate from these receptors (impulse per unit time) is only determined by the frequency of the event which stimulates the receptors - i.e., the heart beat. The question is discussed whether the A-type atrial receptor signals heart rate. (Author)

**A71-36689** Bulbar inhibition of spinal and supraspinal sympathetic reflex discharges. F. Kirchner, A. Sato, and H. Weidinger (Heidelberg, Universität, Heidelberg, West Germany). *Pflügers Archiv*, vol. 326, no. 4, 1971, p. 324-333. 24 refs. Research supported by the Deutsche Forschungsgemeinschaft.

In chloralose anesthetized cats, the sympathetic reflex discharge was recorded from the renal sympathetic nerve. The early-spinal and late-supraspinal sympathetic reflex discharges were elicited by single electrical stimulation of the thoracic dorsal roots. Increased excitation of the baroreceptor afferents produced by a rise of blood pressure after injection of noradrenaline caused strong inhibition of the late-supraspinal reflex discharge. The early-spinal reflex discharge was only rarely affected. Electrical stimulation of the medullary depressor area caused inhibition of the spinal and supraspinal reflex discharges. It is concluded that spinal reflex pathways receive some inhibitory descending influences from the medulla oblongata. (Author)

**A71-36690** State of refraction and image quality of the frog's eye (Refraktion und Abbildungsgüte des Froschauges). Helmut Krueger (München, Technische Universität, Munich, West Germany) and Ernst A. Moser (München, Universität, Munich, West Germany). *Pflügers Archiv*, vol. 326, no. 4, 1971, p. 334-340. 10 refs. In German.

In order to describe the image forming qualities of an optical system it is sufficient to describe its point spread function. A simple apparatus is described with which it is possible to measure the image of a point within a frog's eye. The spread of the image of a point describes the quality of the image. The intensity profile (point spread function) of the image of a point is presented. Measurement of the images of points at different optical distances demonstrates that curarized frogs (Flaxedil, 1 mg/100 g) have a hyperopia of 5.5 D for *R. esculenta* and 7 D for *R. temporaria*. Control measurements with a refractometer confirm this hyperopia in normal and curarized frogs. (Author)

**A71-36691** Effects of 2,3-diphosphoglycerate and other organic phosphate compounds on oxygen affinity and intracellular pH of human erythrocytes. Jochen Duhm (Rheinisch-Westfälische Technische Hochschule, Aachen, West Germany). *Pflügers Archiv*, vol. 326, no. 4, 1971, p. 341-356. 42 refs.

This study revealed that the oxygen affinity as characterized by the P sub 50 (oxygen tension at 50% O<sub>2</sub> saturation) increases from 15 to 45 mm Hg when the 2,3-DPG (diphosphoglycerate) concentration is elevated from 0.1 to 24 micromoles/g by incubation of erythrocytes in the presence of inosine, pyruvate and phosphate. In cells containing normal concentrations of 2,3-DPG, but accumulating high amounts of other organic phosphates during incubation with inosine and phosphate, the P sub 50 was found to rise up to 36 mm Hg. This effect as well as a considerable part of the 2,3-DPG effect on the oxygen affinity of intact erythrocytes is due to a shift of the Donnan equilibrium induced by the accumulation of nonpenetrating phosphate anions and consecutive changes of the intracellular pH, which in turn alter the oxygen affinity via the Bohr effect of hemoglobin. M.M.

**A71-36692** Cold indicator depot with heat exchanger for the thermodilution method (Kälteindikator-Depot mit Wärmeaustauscher für die Thermodilutionsmethode). W. Isselhard, W. Stelter, H. G. Herb, and H. Denecke (Köln, Universität, Cologne, West Germany). *Pflügers Archiv*, vol. 326, no. 4, 1971, p. 357-359. In German.

An instrument for the thermodilution method is described which combines a small heat exchanger with a cold indicator depot. By its use the conditions for the extracorporeal part of the injection system are further standardized and the sources of error of the thermodilution method further reduced. (Author)

**A71-36751** Transmedial collagen and elastin gradients in human aortas - Reversal with age. S. A. Feldman and S. Glagov

(Chicago, University, Chicago, Ill.). *Atherosclerosis*, vol. 13, May-June 1971, p. 385-394. 11 refs. PHS-supported research.

The distribution of collagen and elastin across the aortic media of each of 15 human subjects was determined by analyzing sequential groups of serial sections prepared by cutting through the full thickness of the media from intima to adventitia on a freezing microtome. The ages of the subjects ranged from 8 days to 78 years. Relative transmedial concentrations of collagen and elastin were generally related to age. In children, medial elastin decreased while collagen increased from intima to adventitia. Gradients of opposite direction were found in the aortas of relatively old adults: medial collagen decreased while elastin increased from intima to adventitia. Aortas in which collagen and elastin were distributed more or less uniformly across the media were from relatively young adults. Transmedial scleroprotein gradients and their apparent reversal with age may represent adaptation of the aortic wall to changes in transmedial stress during growth and maturation. The prominence of collagen in the inner media of older individuals with little atherosclerosis suggests that this type of medial fibrosis bears no simple causal relationship to atherogenesis. (Author)

**A71-36859** Union Internationale des Sciences Physiologiques, International Symposium of Behavioral Thermoregulation, Lyons, France, September 7-11, 1970, Proceedings (Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, September 7-11, 1970, Proceedings). *Journal de Physiologie*, vol. 63, May 1971. 288 p. In French, English, and German.

The basic theme of thermoregulative behavior was interpreted in the broad sense, and hence the studies also investigated the nervous control of body temperature and the behavior patterns related to homeothermy such as insulation with clothing, habitations, and food intake. Some of the specific subjects included acclimation to cold, adaptation to high-altitude, and sweat gland studies. An author index is provided.

F.R.L.

**A71-36860** Behavioral temperature regulation in the squirrel monkey - Effects of midbrain temperature displacements. Eleanor R. Adair and John T. Stitt (John B. Pierce Foundation, New Haven, Conn.). (Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) *Journal de Physiologie*, vol. 63, May 1971, p. 191-194. 7 refs. Research supported by the Medical Research Council of Canada; PHS Grant No. ES-00354-02.

Experimental demonstration that direct thermal stimulation of the midbrain reticular formation of squirrel monkeys does not appear to provide an appropriate error signal to alter either physiological or behavioral thermoregulatory responses. It is suggested that perhaps the neural signals from midbrain thermosensitive structures are very weak compared to those emanating from the hypothalamus. Thus it may be that in the intact animal the midbrain has no direct sensory function in thermoregulation but, in the event of injury to such major control centers as the hypothalamus, it could be brought into play to exert at least rudimentary control over thermoregulatory responses.

F.R.L.

**A71-36861** Maximum of evaporative heat loss in relation to clothing thickness. F. W. Behmann (Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Bad Nauheim, West Germany). (Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) *Journal de Physiologie*, vol. 63, May 1971, p. 201-203.

Attempt to determine the limit of evaporation of sweat and the corresponding work load as a function of temperature and clothing

insulation. The maximal evaporation and the permitted work load at this limit were measured for temperatures of -20 to 35 C and with various degrees of insulation. It was found that, in contrast to the nude, the evaporation limit passes through a maximum at about 15 C. The permitted work load was decreased remarkably with increasing insulation, and tended in the cold to a final value not much higher than that at 15 C. The results are explained by a condensation of sweat and show that with a high insulation in cold, very light exercise may cause wetting of clothing. F.R.L.

**A71-36862** Determination of the heat exchange coefficient in water in turbulent flow (Détermination du coefficient d'échange thermique dans l'eau en écoulement turbulent). C. Boutelier, J. Colin, and J. Timbal (Centre d'Essais en Vol, Laboratoire de Médecine Aéropatiale, Brétigny-sur-Orge, Essonne, France). (Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) *Journal de Physiologie*, vol. 63, May 1971, p. 207-209. 8 refs. In French.

Attempt to define the value of the coefficient of heat exchange by convection, using the method of fractional calorimetry. The fasting subjects were almost totally immersed for periods of 90 to 180 min in a tank maintained at constant temperature, with the water in constant circulation. The values given by protected thermocouples were compared with those obtained by thermocouples implanted in the skin (forearm and thigh) in such a way that the thermocouple was on the level of the skin. The temperature difference observed was of the order of 0.1 C, and at times even less for the forearm when the subject was perfectly immobile. F.R.L.

**A71-36863** A mode of thermal adaptation - Shift of threshold temperatures for shivering and heat polypnea. K. Brück, W. Wünnenberg, H. Gallmeier, and B. Ziehm (Giessen, Universität, Giessen, West Germany). (Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) *Journal de Physiologie*, vol. 63, May 1971, p. 213-215.

Study of thermal adaptation of young guinea pigs which had been exposed for periods of 4 weeks at one of three different environmental conditions. One group was maintained at 28 C (WA-animals); a second group at +3 C (CA-animals); and a third group was maintained at 28 to 30 C during the day (12 hr) and at +3 C during the night (CWA: cold-warm-adapted animals). A shifting of threshold temperatures was observed, which might be caused by a functional alteration of a species of nerve cells producing some reference signals for the thermoregulatory system. These postulated cells may be identical to some structures in the hypothalamus, the stimulation of which through noradrenaline leads to a set point shift (Zeisberger and Brück, 1971).

F.R.L.

**A71-36864** Does the mode of sweat water loss influence human thermal regulations. K. J. K. Buettner. (Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) *Journal de Physiologie*, vol. 63, May 1971, p. 216-218. 8 refs.

Examination of some of the assumptions implicit in the equation of total weight loss with water loss of the sweat glands. It is shown that the overall rate of sweating cannot be calculated from either the rate of loss of body weight or from the rate of water loss from the skin at 'representative' sites because (1) in some skin regions emotional sweating is greater than elsewhere; (2) in some areas of skin which are devoid of active sweat glands the rate of water vapor diffusion is much greater than it is through the general skin surface; and (3) the rate of sweating is dependent on the local cutaneous environment. F.R.L.

**A71-36865** Studies on human sweat gland duct filling and skin hydration. R. W. Bullard (John B. Pierce Foundation, New Haven, Conn.; Indiana University, Bloomington, Ind.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 218-221. 7 refs.

Description of a technique for electrical stimulation of human eccrine sweat glands. By analysis of the time delays required for sweat emergence and attainment of steady state rates, and by following the alterations in these delays with varying inter-stimulus times, the volumes of sweat required for duct filling and epidermal hydration may be quantified. F.R.L.

**A71-36866** Experimental determination of the equation making it possible to calculate the mean body temperature in neutral and warm environments (Détermination expérimentale de l'équation permettant le calcul de la température moyenne du corps en ambiance neutre et chaude). J. Colin, J. Timbal, and Ch. Boutelier (Centre d'Essais en Vol, Laboratoire de Médecine Aéronautique, Brétigny-sur-Orge, Essonne, France). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 229-231. 9 refs. In French.

Study of thermoregulation by knowledge of the mean body temperature ( $T_{sub b}$ ), which knowledge is particularly necessary for calculation of the heat debt ( $S$ ), which in general cannot be measured directly.  $T_{sub b}$  was calculated starting with rectal temperature ( $T_{sub re}$ ) and the mean skin temperature. The most important conclusion is that to calculate  $T_{sub b}$  it is essential to relate the different weighted coefficients of  $T_{sub re}$  and mean skin temperature to the thermal neutrality and in a warm environment. This can be interpreted as being the consequence of an increase of the mass of the nucleus and of a reduction of the mass of peripheral tissues during exposure to heat. F.R.L.

**A71-36867** Adaptation to high altitude (4300 M). C. Frank Consolazio, Herman L. Johnson, Harry J. Krzywicki, and Ted A. Daws (U.S. Army, Fitzsimons General Hospital, Denver, Colo.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 232-235. 14 refs.

Evaluation of four parameters as they related to acute mountain sickness (AMS), including heavy physical conditioning prior to altitude exposure; no exercise prior to altitude exposure; the use of high carbohydrate diets; and the maintenance of normal food intakes at altitude. It was found that the daily food intake in human subjects can be maintained after abrupt exposure to high altitude. Positive nitrogen balances can be achieved at altitude; body weight losses are greatly reduced; mineral balances are positive; and fasting glucose levels and glucose tolerance curves are normal. It appears that many of the biochemical changes, previously attributed to hypoxia, that occur during high altitude exposure, may be partially due to anorexia and the subsequent caloric deficit. F.R.L.

**A71-36868** Mechanism of local skin thermoregulation in man essentially controlled by a cooperative biosynthesis of bradykinin. Michel Gautherie (Strasbourg, Université, Strasbourg, France). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 251-253.

Results of recording by infrared thermometry the skin temperature changes following the application on a small skin area (about 7 sq cm) of a thermal stimulus of known temperature and duration. The method allows the quantitative evaluation of the cutaneous

circulatory state in terms of thermoconvectance. The existence of a local skin temperature regulation which is essentially controlled by the adrenergic orthosympathetic system below 30 C is shown. It is controlled above this temperature by bradykinin which is locally synthesized in the skin by a reaction mechanism initiated by histamine. F.R.L.

**A71-36869** Integrative activity of preoptic units. I - Response to local and peripheral temperature changes. J. D. Guieu (John B. Pierce Foundation, New Haven, Conn.) and J. D. Hardy (Yale University, New Haven, Conn.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 253-256. 19 refs.

Attempt to categorize the many types of PAO unit responses to preoptic (PO) and remote temperature changes which have been recorded by various investigators in many species. Data reviewed are summarized and tabulated, and form the support for hypothetical networks (Hardy and Guieu, 1970). An estimate of the input and output of each unit is also given. The data indicate that both thermal and nonthermal signals converge on units in the PO; signals elicited by temperature changes in the PO midbrain, spinal cord, and skin converge in the PO area; and most, if not all, PO neurons which are responsive to these remote nonthermal and thermal stimuli also have nonlinear responses to preoptic temperature changes. F.R.L.

**A71-36870** Integrative activity of preoptic units. II - Hypothetical network. J. D. Hardy (John B. Pierce Foundation, New Haven, Conn.) and J. D. Guieu (Yale University, New Haven, Conn.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 264-267.

Use of data on temperature-sensitive neurons of the preoptic anterior hypothalamic area (POA) to determine what rational relationship can be visualized between the different types of unit responses already identified. It was determined that the observed POA unit responses can be used as a basis for a conceptualized interneuron network, and that two networks are required, one for hyperthermia and another for hypothermia. The networks are affected by temperature changes in many parts of the body; in general, summing of activity is characteristic with some indication of multiplication. Comparison of the outputs from a computer model of a control system for physiological thermoregulation and neuronal networks shows similarity, indicating that the neuronal networks are compatible with thermoregulatory requirements. F.R.L.

**A71-36871** Human physiological responses to heat stress - Males and females compared. Bruce A. Hertig (Illinois, University, Urbana, Ill.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 270-273. 18 refs.

Review of the differences in physiological responses of women and men to heat stress, as revealed by the literature reporting studies on women subjects. It is suggested that the differences are sufficiently great to warrant adjustments in the several indices of thermal stress currently in use, and that there may be increased risks to female employees working in a hot environment. F.R.L.

**A71-36872 \*** Control of brown fat thermogenesis - A systems approach. J. M. Horowitz, B. A. Horowitz, and R. Em. Smith (California, University, Davis, Calif.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*)

*Journal de Physiologie*, vol. 63, May 1971, p. 273-276. 12 refs. NIH Grant No. BS-24055; Grant No. NGR-05-004-035.

Experimental approach to the control of brown fat thermogenesis using intact, unanesthetized, unrestrained animals (Long-Evans rats). For these intact animals, the input which was varied was the temperature of the interscapular brown fat. The discussion is centered around brown adipose tissue and its afferent nerves. These neurons and adipocytes may be studied at a cellular level wherein properties such as membrane depolarization are related to system components. On the other hand, the response of the brown fat can be considered within the context of a larger system. Thus the central control of brown fat thermogenesis, which was found to be consistent with a proportional-plus-rate controller, can be placed in parallel with central nervous system controller of other thermogenic mechanisms.

F.R.L.

**A71-36873** Skin temperature and perspiration (Température cutanée et évaporation sudorale). Y. Houdas, J. Colin, J. Timbal, J. D. Guieu, and C. Boutelier (Centre d'Essais en Vol, Laboratoire de Médecine Aéropatiale, Brétigny-sur-Orge, Essonne; Lille, Université, Lille, France). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 277-279. In French.

Results of an experimental study of the mechanism of elimination of metabolic heat through the skin. It is noted that the skin temperatures in different parts of the body are different at the same ambient temperature. A relation between the mean skin temperature and the ambient temperature is presented. It is shown that the evaporation efficiency does not vary as a function of the wind speed in the same way as the heat load, thus confirming the hypothesis that the evaporation coefficient is larger than the convection coefficient.

A.B.K.

**A71-36874** The response of the human thermostat to a gradient input of the external heat load (La réponse du thermostat humain à une entrée-pente de la charge thermique externe). Yvon Houdas and Annie Sauvage (Lille, Université, Lille, France). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 279-281. In French. Research supported by the Direction des Recherches et Moyens d'Essais.

Study of the variation in the response of human subjects to a linearly increasing external heat load. In one group of subjects the time constant generally exceeds 8 to 10 min, and the sweat response appears regular if the heat load gradient is high. In the other group the time constant is low (of the order of 5 min), and regardless of the value of the gradient the response is irregular. It is suggested that the regularity of the development of perspiration under the investigated conditions increases with an increase in the time constant of the subject, on the one hand, and an increase in the rate of variation of the heat load, on the other hand. This hypothesis is confirmed by an analog computer experiment. It is concluded that under certain experimental conditions the sweat system can be regarded as a linear system.

A.B.K.

**A71-36875** Temperature and tolerance during exposure to hot and cold environments. P. F. Iampietro (FAA, Physiology Laboratory, Oklahoma City, Okla.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 282-284.

Investigation of the possibility of using a single physiological measure to predict tolerance time for humans in all thermal environments. It is shown that skin temperature is a sensitive and

accurate indicator of tolerance in man exposed to thermal environments. Skin temperature at ten minutes of exposure may be used to predict final skin temperature and tolerance time.

F.R.L.

**A71-36876** The use of a model in the analysis of the relation between skin temperature and the rate of sweating. K. Ibamoto (Hokkaido University, Sapporo, Japan). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 284-287.

Proposal of an index (the 'chill level') to determine the influence of skin temperature during heavy work on the rate of evaporative heat loss and thermal information to the central controller. The chill level relates the thermal stimulus to the rate of evaporative heat loss during different degrees of work and of external insulation (clothing).

F.R.L.

**A71-36877** Impulse coding in primate cutaneous thermoreceptors in dynamic thermal conditions. A. Iggo (Edinburgh, University, Edinburgh, Scotland) and Betty J. Iggo (Ibadan, University, Ibadan, Nigeria). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 287-290. 7 refs. Research supported by the Wellcome Trust.

Assessment of the 'dynamic' sensitivity of thermoreceptors in single fibers by slowly moving the temperature of the skin across the thermal response range of the receptor, keeping a uniform rate of change of temperature. Thus it was possible to sample the full range of response of a given thermoreceptor, and different receptors could be compared by using standard conditions. Results show that individual cutaneous cold receptors in the primate have encoded the temperature of the skin more efficiently than in nonprimates and that within a range from 35 to 20°C there is a pattern uniquely determined by the thermal conditions.

F.R.L.

**A71-36878** Respiratory aspects of a hyperbaric thermal environment (Aspects respiratoires de l'environnement thermique hyperbare). Charles Jacquemin, Pierre Varène, and Jean L'Huilier (Centre d'Essais en Vol, Laboratoire de Médecine Aéropatiale, Brétigny-sur-Orge, Essonne, France). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 293-295. 10 refs. In French.

Study of the role of heat exchange by convection in humans in a hyperbaric thermal environment. An attempt is made to obtain an equation for predicting the increase in the specific heat of the ventilated gas and thus an increase in heat dissipation by convection as a function of the environment and the physical activity of the subject. The mechanisms of passive control of the temperature of the alveolocapillary exchange zones are ascertained. In contrast to the tegumentary heat exchanger, the pulmonary heat exchanger (at least in man) is not under the active control of the thermoregulating system but is under the control of the system regulating gaseous exchanges.

A.B.K.

**A71-36879** Temperature regulation in exercise - The characteristics of proportional control. E. Jéquier, M. Dolivo, and A. Vannotti (Lausanne, Université, Lausanne, Switzerland). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 303-305.

Description of experiments designed to test in man whether the set point temperature is shifted during exercise. In addition, the influence of mean skin temperature during work on the set point temperature and on the proportionality constants for the sweat rate and for the thermal skin conductance was investigated. Greater evaporative loss was observed during exercise than at rest, and respiratory water loss rose also. The main increase in evaporative heat loss originated from the skin. F.R.L.

**A71-36880 Cardiovascular responses to induced brain temperature changes.** James H. Magilton and Curran S. Swift (Iowa State University of Science and Technology, Ames, Iowa). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 328-331. 6 refs.

Use of the findings of Forbes and Wolff (1928) and Risberg et al. (1969) in studying the effects of temperature on the cerebral vasculature. The temperature of the angularis oculi vein was varied by water irrigation of the alar fold of the maxilloturbinate. It was found that changing the temperature in the vascular plexus in the tip of the nose of dogs produced repeatable variations in cerebrospinal fluid pressure, systemic arterial blood pressure, and heart rate. The changes in these variables were such that brain circulation could have been affected significantly. F.R.L.

**A71-36881 Modifications of the thermoregulation of a hibernating rodent following thyroidectomy and cold adaptation** (Modifications de la thermorégulation d'un rongeur hibernant à la suite de la thyroïdectomie et de l'adaptation au froid). A. Malan (CNRS, Laboratoire de Physiologie Respiratoire, Strasbourg, France) and B. Canguilhem (Strasbourg, Université, Strasbourg, France). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 332, 333. 7 refs. In French.

Comparative study of the effects of thyroidectomy and cold adaptation on hamsters at 7 and 20 C. It is found that both thyroidectomy and cold adaptation produce in the hamster a reduction of the threshold temperature at which thermal regulation sets in. The effects of the two factors can be combined. Thyroidectomy, but not cold adaptation, also results in a reduction of the heat transfer coefficient. A.B.K.

**A71-36882 Heart rate responses to industrial heat stress.** David Minard and Rainer Goldsmith (Pittsburgh, University, Pittsburgh, Pa.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 342-345. PHS Grant No. RO1 EC 00310.

Study of physiological strains in men working in a hot environment. These strains vary, depending both on the work capacity of the individual as well as on the varying demands of the task. One criterion for judging whether work strains are excessive is a decrement in cardiocirculatory performance capacity after work. Prevention of health hazards to such workers will require either selection of workers of superior heat tolerance or better engineering control of environmental heat stress. F.R.L.

**A71-36883 Analysis of the rate of digital cooling.** G. W. Molnar (U.S. Veterans Administration Hospital, Little Rock, Ark.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 350-352.

Attempt to correlate the elapsed time to freezing of a finger with the rate of cooling by obtaining a numerical value for the rate. Experiments were performed on young male volunteers. Because of indeterminate supercooling the onset of digital freezing could not be related to the relative cooling rate. The time to the start of cold-induced vasodilatation was seemingly inversely related to the relative cooling rate. F.R.L.

**A71-36884 Physiologic control of rate of local sweat secretion in man.** Ethan R. Nadel (John B. Pierce Foundation, New Haven, Conn.) and J. A. J. Stolwijk (Yale University, New Haven, Conn.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 353-355. 7 refs.

Results of monitoring local sweating (under conditions of elevated internal and mean skin temperatures) to obtain information regarding the efferent activity from the thermoregulatory center. Six young male adults underwent supine exposures to fixed ambients between 25 and 35 C with RH between 80 and 90 per cent, and minimal air movement. A hypothetical description of the control of local sweating rate was developed. There was a good deal of interindividual variability in the values of each constant in the controller equation, but the equation itself was consistently supported. F.R.L.

**A71-36885 The potohydrotic reflex and a study of its neurophysiological mechanism** (Réflexe potohydrotique et étude de son mécanisme neurophysiologique). S. Nicolaidis (Collège de France, Paris, France). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 359-361. 10 refs. In French.

Study of the perspiration delay times characterizing the potohydrotic reflex in human subjects subjected to controlled dehydration and subliminal heating to produce sweating. Fresh water at 12 or 37 C and salt water with a concentration of 9% is found to produce a prolonged sweat discharge after a delay time of 2 to 7 sec in the subjects studied. The same stimulations applied to the same subjects after massive dehydration make the sweat response disappear. These extremely short delay times suggest the existence of an entirely nervous reflex with a peripheral point of departure. A study is made of the neurophysiological mechanism of the potohydrotic reflex by performing electrophysiological explorations on a series of anesthetized cats, an attempt being made to locate oral receptors in centers related to hydromineral regulation. A.B.K.

**A71-36886 Exercise temperature plateau shifted by a moderate carbon monoxide poisoning.** B. Nielsen (Copenhagen, University, Copenhagen, Denmark). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 362-365. 9 refs.

Investigation of the mechanisms involved in body temperature changes during work by lowering the maximum O<sub>2</sub> uptake in subjects by letting them inhale CO. It was found that, if the central temperature rise in the CO experiments represents a 'resetting' of the thermoregulating centers, the higher sweat rate in the CO experiments may be the direct response to the increased central temperature. The increased evaporative cooling of the skin decreases the skin temperature and increases the core-surface gradient. By this both the conductive and convective heat transfer are enhanced since for the larger gradient each volume of skin blood flow carries more heat to the surface, and the skin blood flow can be reduced as found. M.M.

**A71-36887** Humid operative temperature - A biophysical index of thermal sensation and discomfort. Y. Nishi (John B. Pierce Foundation, New Haven, Conn.) and A. P. Gagge (Yale University, New Haven, Conn.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 365-368.

Humid operative temperature, when derived from the heat balance equation for a temperature regulating physiological model incorporating the effector processes of sweating, vasodilation, and vasoconstriction, is a unique function of the environmental variables. This temperature scale is useful as a rational index for biophysical thermometry and for predicting thermal sensations and discomfort in widely varying environments. M.M.

**A71-36888** Effect of temperature change of the preoptic region and skin on posterior hypothalamic neurons. Stephen L. Nutik (McGill University; Montreal Neurological Institute, Montreal, Canada). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 368-370. 8 refs. Research supported by the Medical Research Council of Canada.

Extension of observations on posterior hypothalamic units in cats responsive to preoptic temperature change. Neurons were found in the posterior hypothalamic area which responded to preoptic region temperature change. Most of these units increased firing rate with cooling. Cutaneous temperature change was also found to affect posterior hypothalamic units. The number of units responding to both preoptic and skin temperature change was greater than that expected from the number responding to change at only one site or the other. M.M.

**A71-36889** Sudomotor activity with and without generalized sweating. Tokuo Ogawa and Robert W. Bullard (Indiana University, Bloomington, Ind.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 371-373. USAF-Army-supported research.

Simultaneous treatment of different skin areas with pilocarpine produces synchronous expulsions of sweat even at relatively cool room temperatures. The frequency of these sweat expulsions appears to be a linear function of ambient temperature regardless of the presence or absence of generalized sweating. M.M.

**A71-36890** Spinal excitation and inhibition during local spinal cooling and warming. Fr.-K. Pierau and F. W. Klusmann (Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Bad Nauheim, West Germany). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 380-382. 10 refs.

Investigation of possible temperature dependent changes of spinal inhibitory processes in cats which might play a role in the generation of motoneurons discharge frequency curves. It is pointed out that the experimentally found simultaneous increase of inhibition seems to render unnecessary the terms of Brooks et al. (1955) that cooling induces in spinal neurons a state of 'hyperresponsiveness' while at the same time it leaves them 'hypoexcitable.' It also explains the phenomenon that, in spite of increasing excitability of the neuron during cooling, its discharge frequency might disclose a maximum curve. M.M.

**A71-36891** Theoretical considerations concerning heat regulation under stringent low-temperature conditions (Theoretische Betrachtung zur Thermoregulation bei hoher äusserer Kältebelastung). Leo Priebe (Marburg, Universität, Marburg an der Lahn, West Germany). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 389-392. In German.

Biological and energy considerations are presented in support of the concept of a thin heat shell about a core, which is responsible for heat regulation in a homoiothermic organism. A model consisting of a heat shell and an insulation shell about a core is examined in which 33 homogeneous and isotropic zone media contain consistently distributed heat sources. V.P.

**A71-36892** Convection coefficients of man in a forensic area of thermal physiology - Heat transfer in underwater exercise. Georges M. Rapp (John B. Pierce Foundation, New Haven, Conn.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 392-396. 6 refs.

Development of a rational method of analysis for predicting the convective and conductive heat losses of underwater swimmers and divers exercising in cold water. The method is based upon the assumption that a heat balance with exercise in 22 C water can be maintained for reasonable durations of time by the swimmer. Subject to prescribed conditions, it is concluded that because the peripheral internal body tissues have conductive resistances 15 to 32 times larger than the convective resistance of the external body surface, internal conduction instead of external convection governs. F.R.L.

**A71-36893** Temperature regulation in swimming. Sid Robinson and Alan Somers (Indiana University, Bloomington, Ind.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 406-409. Contract No. DA-49-193-MD-2449.

Review of data obtained in a series of experiments designed to determine the effects of varying water temperature on the temperature regulation of champion swimmers. A comparison is made of the swimmers' responses during swims at various water temperatures with those of a highly trained track man running on the treadmill at the same metabolic rate as that of the swimmers. M.V.E.

**A71-36894** Ascending neurons highly sensitive to variations of spinal cord temperature. Eckhart Simon and Masami Iriki (Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Bad Nauheim, West Germany). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.*) *Journal de Physiologie*, vol. 63, May 1971, p. 415-417. 5 refs.

Data resulting from described experiments with anesthetized cats show that signals conducted by the spinal cold- and heat-sensitive ascending fibers are evoked by temperature effects on spinal structures with basically afferent function. Comparisons of the temperature-sensitive spinal units with hydrothalamic temperature sensors reveal that their sensitivities are of the same order of magnitude. M.V.E.

**A71-36895** Eco-physiological patterns of thermoregulation and the shivering thermogenesis. A. D. Slonim (Akademiia Nauk SSSR, Institut Fiziologii, Novosibirsk, USSR). (*Union Inter-*

*nationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) Journal de Physiologie, vol. 63, May 1971, p. 418-420. 16 refs.*

Experimental data are reviewed that were obtained in recent studies of shivering and nonshivering thermogenesis in the course of cold adaptation of an organism, and in investigations of the role of various organs and systems in the origin of these forms of heat production. These data show that the shivering activity of skeletal muscles in the course of individual and genetic adaptation does not remain constant in its thermogenetic effect. The switchover of the shivering thermogenesis to the nonshivering one is linked with both the change in calorific capacity of the muscular contraction activity and the change in heat production in the visceral organs including the digestive tract, the heart, the diaphragm, etc. M.V.E.

**A71-36896**      **The relation between behavior and physiology in the thermoregulatory response of the squirrel monkey.** J. T. Stitt, E. R. Adair, E. R. Nadel, and J. A. J. Stolwijk (John B. Pierce Foundation, New Haven, Conn.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) Journal de Physiologie, vol. 63, May 1971, p. 424-427.*

Review of the results of experiments using a male squirrel monkey and designed to study the interrelation between the elements of the central nervous system that control behavioral thermoregulation and those which control physiological thermoregulatory mechanisms. The results obtained are consonant with the idea that the controller of behavioral thermoregulation is identical in its characteristics with the controller of physiological thermoregulation. No evidence was found that could support the notion that these controllers are separate or distinct. M.V.E.

**A71-36897**      **Study of human perspiration under transient conditions (Etude de la sudation de l'homme en régime transitoire).** J. Timbal, J. Colin, and C. Boutelier (Centre d'Essais en Vol, Laboratoire de Médecine Aéronautique, Brétigny-sur-Orge, Essonne, France). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) Journal de Physiologie, vol. 63, May 1971, p. 442-445. 5 refs. In French.*

Determination of the time constant for the onset of perspiration in human subjects exposed to a stepwise increase in the external heat load. It is shown that the rate of onset of perspiration is relatively slow, since even in the fastest cases observed the time constant did not go below 6 min. Moreover, in spite of a certain spread of the results, it is concluded that the mean value of 12.20 min is representative of the majority of experiments. A.B.K.

**A71-36898**      **Thermosensitivity and veins.** P. M. Vanhoutte (Gent, Rijksuniversiteit, Ghent, Belgium) and J. T. Shepherd (Mayo Foundation, Rochester, Minn.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) Journal de Physiologie, vol. 63, May 1971, p. 449-451. 21 refs.*

The results obtained in many investigations of venous thermoregulatory reactions are reviewed, and a further analytical study of local thermosensitive mechanisms is reported. This study was conducted on excised segments of dog's saphenous veins perfused at constant flow with autologous blood or Krebs-Ringer solution. Changes in driving pressure were used for measuring venomotor responses. The obtained results include the finding that the temperature sensitivity of the venomotor reaction was still present when the Krebs-Ringer solution was used instead of autologous blood. M.V.E.

**A71-36899**      **Comparison of computed results obtained from two mathematical models - A simple 14-node model and a complex 250-node model.** Eugene H. Wissler (Texas, University, Austin, Tex.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) Journal de Physiologie, vol. 63, May 1971, p. 455-458. 6 refs.*

The accuracy of a simple mathematical model for the human thermal system is checked by comparing computed results with those obtained from a more accurate model. There is good agreement at all times between head core temperatures computed with the two models. This is believed to be indicative of the strong dependence of head core temperature on central blood temperature, which, in turn, is sensitive to the overall energy balance. Transient fluctuations in temperature are more pronounced for the more accurate model than for the simpler one. The initial dip in head core temperature can be attributed to vasodilation in the extremities, and the dip in skin temperature results form the onset of rapid sweating. It is concluded that the use of simple models is probably justified in those cases which involve pronounced vasodilation and small differences between central and surface temperatures. M.V.E.

**A71-36900**      **Heat transfer coefficients of humans in cold water.** J. M. Witherspoon, R. F. Goldman, and J. R. Breckenridge (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) Journal de Physiologie, vol. 63, May 1971, p. 459-462.*

Combined heat-transfer coefficients calculated from heat balance equations for humans in cold water are compared with free convection coefficients calculated from equations for heated cylinders in cross-flowing water applied to a man immersed to neck level in such water at 20 C and also derived from experiments with a 'nude' copper manikin. The probable causes of the substantial differences between the coefficient values thus obtained are discussed. M.V.E.

**A71-36901**      **Effect of intrahypothalamic noradrenaline-injection on the threshold temperatures for shivering and nonshivering thermogenesis.** Eugen Zeisberger and Kurt Brück (Giessen, Universität, Giessen, West Germany). (*Union Internationale des Sciences Physiologiques, Symposium International de Thermorégulation Comportementale, Lyons, France, Sept. 7-11, 1970.) Journal de Physiologie, vol. 63, May 1971, p. 464-467. 6 refs.*

Experiments with guinea pigs designed to clarify central effects of noradrenaline show that there are certain cell groups in the anterior hypothalamus, the stimulation of which results in an alteration of the thermoregulatory system characterized by an elevation of the threshold temperature for cold-induced heat production. The cells responsible for this effect are not identical with the highly thermosensitive units of the preoptic region, but rather with certain thermoinsensitive structures located more caudally. M.V.E.

**A71-36912**      **The human operator in optical tracking systems.** Russell L. Smith (Integrated Sciences Corp., Santa Monica, Calif.). In: *Optical tracking systems; Society of Photo-optical Instrumentation Engineers; Seminar-in-Depth, El Paso, Tex., January 18, 19, 1971, Proceedings.* Seminar co-sponsored by the U.S. Army. Edited by J. G. Muhlberger and E. D. Miller. Redondo Beach, Calif., Society of Photo-optical Instrumentation Engineers (SPIE Seminar Proceedings. Volume 23), 1971, p. 103-110.

Results of experimental research conducted with human operators to provide design data for high inertia tracking systems used in photographic recording of missile flights. The purpose of the study was to identify and evaluate variables affecting human

performance in field tracking tasks. Five sets of experiments considered the roles played by proprioceptive feedback, display magnification, control dynamics, field of view, type of controller, and predictive or anticipatory processes. Results which have implications for the design of field tracking mounts are interpreted. T.M.

**A71-36944 #** Cross-sectional and longitudinal study of fear and its mastery (Eine Querschnitts- und Longitudinal-Untersuchung über Angst und ihre Beherrschung). Walter D. Fenz (Waterloo, University, Waterloo, Ontario, Canada). *Zeitschrift für experimentelle und angewandte Psychologie*, vol. 18, 2nd Quarter, 1971, p. 189-203. 5 refs. In German.

Study of the interrelation between long experience in the sport practice of parachute jumping and superficial skin excitation reflexes electrically induced in response to stimulus words variously relevant to the parachute jump sport. The results obtained indicate a highly consistent gradual increase in responsiveness to stimuli on the lower end of the dimension, and a decrease in responsiveness to the more highly relevant stimuli as a function of experience. This shows that the diagnostic tools and response measurement techniques used were both valid and reliable for measuring fear and its mastery in the chosen real-life experimental situation. M.V.E.

**A71-36945 #** Psychophysics and reactive exertion increase (Psychophysik und reaktive Anspannungssteigerung). Otto Heller (Erlangen-Nürnberg, Universität, Nürnberg, West Germany). *Zeitschrift für experimentelle und angewandte Psychologie*, vol. 18, 2nd Quarter, 1971, p. 204-254. 41 refs. In German.

An experimental technique is described for the demonstration of the phenomenon of reactive exertion increase (REI) originally observed by Düker (1963). Düker defined this phenomenon as the unconscious or involuntary mental effort intensification occurring in the course of any goal-directed activity in progress, at the emergence of slight, barely noticeable inhibitions which the subject tries to overcome for the sake of activity-goal achievement. The proposed technique is shown to be substantially less time-consuming than the procedures used by Düker, and to bear out completely Düker's observations. Their implications are discussed in the light of the experimental results obtained, as well as in that of other investigators' contributions. M.V.E.

**A71-36972 #** Foot operation of controls. K. H. E. Kroemer (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). *Ergonomics*, vol. 14, May 1971, p. 333-361. 68 refs. Contracts No. AF 33(615)-67-C-1280; No. AF 33(615)-67-C-1310.

The literature pertaining to foot operation of controls is reviewed and a new experiment reported. Published experimental results clarify only some isolated aspects of leg and foot motions. Even the relatively often investigated speed of operating pedals and forces that can be applied to them were studied under such different experimental conditions that no general statements are possible concerning what pedal can be operated most quickly or forcibly. Opinions about the advantages and disadvantages of hand versus foot operation seem not generally based on experimental findings. In an experiment, 20 seated young adult male subjects moved their right foot as rapidly as possible over distances of 15 cm to circular targets. The direction of these discrete movements had no appreciable effect on the accuracy of motion. Forward motions of the vertical or almost vertical lower leg were slightly faster than backward or lateral motions of the elevated lower leg. All motions could be performed in about 0.1 seconds. (Author)

**A71-36973** An evaluation of the usefulness of four secondary tasks in assessing the effect of a lag in simulated aircraft dynamics. H. F. Huddleston and R. V. Wilson (Royal Aircraft

Establishment, Farnborough, Hants., England). *Ergonomics*, vol. 14, May 1971, p. 371-380. 8 refs.

Eight male subjects were required to perform a tracking task using an electronic windshield display. The task had two levels of difficulty, an essentially unlagged condition and a condition, chosen to be perceptibly more difficult, having an exponential lag of 0.5 sec. Integrated tracking error scores alone were unable to distinguish between the two difficulty levels. Four secondary tasks were utilized involving a response to digits presented in the forward field of view. The four tasks were arranged to be of comparable difficulty level in pretests using the same subjects. Two secondary tasks indicated a difference between the primary task conditions. The addition of a secondary task also permitted tracking error scores themselves to indicate a difference. (Author)

**A71-36974** The feasibility of using an adaptive technique in flight simulator training. N. C. Ellis (Texas A & M University, Bryan, Tex.), Ann L. Lowes, W. G. Matheny, and D. A. Norman (Life Sciences, Inc., Fort Worth, Tex.). *Ergonomics*, vol. 14, May 1971, p. 381-389. 9 refs. Contract No. N-61339-1889.

This study explores the feasibility of using an adaptive technique in flight simulator training to improve piloting skills. An operational flight simulator is used to simulate a jet fighter aircraft. Eighteen non-jet-experienced pilots are assigned to two groups for the purpose of receiving equivalent amounts of practice in the task of maintaining a constant altitude program during simulated air turbulence. One group is trained using an adaptive technique and the other is trained under conditions more representative of conventional training. The hypothesis is that an adaptive technique is feasible if adaptively trained pilots are more proficient than conventionally trained pilots when transferred to a flight simulation representative of an aircraft in turbulent air. Resulting data support the hypothesis. (Author)

**A71-36975** Fatigue effects on patterns of movement. F. P. Jones and J. A. Hanson (Tufts University, Medford, Mass.). *Ergonomics*, vol. 14, May 1971, p. 391-410. 7 refs. Contract No. DA-49-193-MD-2665.

The standing broad jump and four other gross body movements were analyzed by color-coded multiple-image photography before and after three kinds of fatigue-inducing exercise. For each movement marked individual differences in style of performance were found which tended to persist despite the effects of fatigue. Certain linear and angular measures taken from the movement patterns proved to be sensitive to fatigue effects. The amount and significance of change in the different indices varied with the method used for inducing fatigue. (Author)

**A71-37016** Effect of images in six sense modalities on detection of visual signal from noise. Sydney Joelson Segal and Vincent Fusella (New York, City University, New York, N.Y.). *Psychonomic Science*, vol. 24, July 25, 1971, p. 55, 56. 5 refs. Contract No. AF 44(620)-68-C-0093.

Ss were asked to generate images in six different sense modalities, and a visual display was presented while they were imaging. The display consisted of a geometric pattern, and a small dim colored figure was present within the pattern on half the trials. Ss' ability to detect the figure was compared in the imaging task and in a standard discrimination task without imagery. Sensitivity ( $d'$ ) was significantly poorer during imaging than during discrimination, was worse during visual imagery than during imagery of auditory, olfactory, gustatory, tactile, or kinesthetic objects, and was worse with images of relatively unfamiliar items. This phenomenon seems due to selective attentional effects. (Author)

**A71-37017** Exposing an individual to two types of prisoner's dilemma game matrix formats. Thomas L. Radinsky (Iowa,



University, Iowa City, Iowa). *Psychonomic Science*, vol. 24, July 25, 1971, p. 62-64. 7 refs.

A study was conducted to provide direction to further research and theorizing concerning the nature of the variables that cause people to respond differentially to structurally different, but theoretically equivalent, matrix formats. Changes in the response pattern of a single individual were observed as a function of the matrix format presented. These results were interpreted as suggesting that individuals are responsive to such nonstrategic factors as format and that research should be directed at identifying and assessing the influence of these psychologically important factors. (Author)

**A71-37018**      **Judgment of temporal duration as a function of numerosity.** Suchoon S. Mo (Detroit, University, Detroit, Mich.). *Psychonomic Science*, vol. 24, July 25, 1971, p. 71, 72.

In judging brief stimulus duration, change of the number of dark dots from three to one resulted in underestimation, while similar change from three to five resulted in overestimation. Such a trend of temporal judgment was accentuated when the change was less frequent, demonstrating a contrast effect. But the analogous contrast effect was also obtained when the stimulus duration itself was changed. (Author)

**A71-37019**      **Zöllner illusion as perceptual enlargement of acute angle.** K. G. White (Otago, University, Dunedin, New Zealand). *Psychonomic Science*, vol. 24, July 25, 1971, p. 73-75. 11 refs.

Measurement of the magnitude of the Zöllner illusion as a function of the angle between the test and inducing lines for a number of different background densities. The magnitude of the Zöllner illusion varies according to the angle of intersect between the test and inducing lines and is maximal at about 20 deg of intersect angle. Increasing the density of the inducing lines multiplies the illusion by a constant amount. Obtained error functions agree well with error functions derived according to Piaget's law of relative centration. M.M.

**A71-37020**      **Timing oscillation in human visual imagery.** Herbert F. Crovitz (U.S. Veterans Administration Hospital, Durham, N.C.), Daniel Rosof, and Harold Schiffman (Duke University, Durham, N.C.). *Psychonomic Science*, vol. 24, July 25, 1971, p. 87, 88. 8 refs.

Following the work of Weber & Castleman (1970), who found a time period of about 500 msec for the successive production in imagery of letters of the alphabet, an imaginal task less cognitive in nature was timed. Twenty-four Ss in a CFF study attempted to match the rate of flicker of a subfusional light in visual imagery. The modal ability for imagining flicker is about 250 msec in period. (Author)

## STAR ENTRIES

**N71-29216\*** Technology, Inc., San Antonio, Tex. Life Sciences Div.

### **STUDY OF PHYSIOLOGICAL TOLERANCE TO CENTRIFUGATION Final Report**

D. M. Miller, B. Ward, J. V. Benedict, and J. A. Nickel 15 Jun. 1971 20 p refs

(Contract NAS9-11314)

(NASA-CR-115068) Avail: NTIS CSCL 06S

A centrifuge bed rest study designed to determine the physiological effects of acceleration, following simulated weightlessness, was performed. Procedures involved in the experimental design, maintenance of the subjects, instrumentation scheduling, and data coordination and reduction are outlined. Preliminary results show a general decrease in tolerance to +G sub z acceleration loads following seven days of bed rest. Author

**N71-29228\*** Texas A&M Univ., College Station.

### **BACTERIOLOGY OF SELECT AQUATIC HOSTS UTILIZED IN LUNAR SAMPLE EXPOSURE STUDIES Final Report**

D. H. Lewis 20 May 1971 5 p refs

(Contract NAS9-10830)

(NASA-CR-115064) Avail: NTIS CSCL 06M

The screening of Apollo mission aquatic test animals for pathogenic bacteria is cited. Immunofluorescent techniques developed for processing specimens in confined environments are reported with processing techniques for large numbers of bacterial isolates utilizing limited space and minimal amounts of test media. Test results are presented in tabular form. J.M.

### **N71-29249# California Univ., Berkeley. Lawrence Radiation Lab. THE USE OF THE EXISTING CHARGED HEAVY PARTICLE ACCELERATORS AND THE POSSIBILITIES OF CREATING NEW DOMESTIC ONES FOR RADIATION THERAPY**

V. P. Dzhelepov et al Sep. 1970 36 p refs Transl. into ENGLISH of Russian report JINR-P9-4560 Presented at the Symp. on Probl. in the Develop. of Radiation Therapy Tech. in Oncology, Moscow, Apr. 1969

(UCRL-Trans-1422; Conf-690448-1; JINR-P9-4560) Avail: NTIS

Therapy of malignant tumors by means of heavy particles of high energies is a progressive principle in medicine promising success. The accelerated development of ion-corporuscular therapy and its use with electron-photon therapy is an urgent problem. Existing proton accelerators opened a front for clinical and research work. The construction of a series of special medical accelerators and the necessary equipment for a number of oncological institutes is not connected with any serious technological difficulties and requires no excessive capital expenditures. Author (NSA)

**N71-29257#** Joint Publications Research Service, Washington, D.C.

### **MAIN DIRECTION OF MATHEMATICAL MODELING IN MICROBIOLOGY**

A. M. Bezborodov et al 24 Jun. 1971 9 p ref Transl. into ENGLISH from Prikl. Biokhim. Mikrobiol. (Moscow), v. 7, no. 3, 1971 p 251-258 Presented at the All-Union Microbiol. Soc., Moscow, Feb. 1970

(JPRS-53452) Avail: NTIS

The general problems involved in mathematical modeling of microbiological processes and different aspects of resolving some of the most pressing problems at this stage of development of research and production in the field of microbiological synthesis are discussed. Special attention is given to methodological aspects of modeling, the problem of creating a model of the cell of a microorganism and a model of a population of microbial cells; to the control of biosynthetic processes and influence of different exogenous factors on microbiological synthesis; to optimization conditions and methods. Author

**N71-29308#** Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.

### **MEDICAL AND PSYCHOLOGICAL ASPECTS OF MASS AIR TRANSPORTATION**

S. J. Gerathewohl, S. R. Mohler, and P. V. Siegel Mar. 1971 31 p refs

(FAA-AM-71-10) Avail: NTIS

The increase in air transportation depends not only on the technological progress and the availability of more and larger aircraft, but also on the corresponding increase in flight safety. Since, in most of the aircraft accidents, pilot error is a contributing factor, research concerning the medical and human factors must be expanded to include the new generation aircraft, in particular, the jumbo jets and air buses which are the means of mass air transportation. Moreover, the medical aspects of airports must be adjusted to serve the increasing number of crews, passengers and patients. Means must be provided for first aid, quarantine and the prevention of infectious diseases through air transportation; and a disaster plan must be established for all major airports. Finally, the effects of mass air transportation on the environment must be considered in order to protect the quality of life. Author

**N71-29325\*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

### **SPACE STATION RF HAZARDS**

R. A. Inman In its Instrumentation and Commun. Res. at MSFC. Vol. 4 May 1971 p 51-55 refs

Avail: NTIS CSCL 06R

Harmful biological effects that may be caused by exposure to microwave radiation are discussed. Typical values of radio frequency (RF) power density in the vicinity of space station antennas are calculated and compared to existing microwave exposure standards. It is shown that the currently accepted limit for exposure to rf radiation can be exceeded easily in the near field of high gain antennas on the space station. Author

**N71-29327#** Oxford Univ. (England). Engineering Lab.

### **THE TRANSMISSION OF LOAD THROUGH THE HUMAN HIP JOINT**

A. S. Greenwald and J. J. O'Connor 1971 47 p refs Sponsored by Arthritis and Rheumatism Council

(LAB-1002/71) Avail: NTIS

The results of loading experiments carried out on human hip joints during normal walking are described. Two distinct contact areas were found on the anterior and posterior aspects of the acetabulum at light loads, gradually merging with increasing load until, at a certain transition load, the dome of the acetabulum comes into contact and contact is then complete. The value of the transition load depends on the rate of loading, due to creep of the cartilage, and was found to vary from 50% of body weight in

young specimens to 25% of body weight for elderly specimens for rates of loading typical of normal walking. The analysis of a much simplified model of the hip joint is presented, the dependence of contact area on load is demonstrated, and a method of determining the transition load for complete contact from the load/deflection relation for the hip is suggested. It is concluded that the function of joint incongruity is to allow the articular surfaces to come out of contact at light loads so that the cartilage may be exposed to synovial fluid for the purposes of nutrition and lubrication.

Author (ESRO)

**N71-29358#** Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.

**SOME CONSIDERATIONS IN ESTABLISHING PURITY STANDARDS FOR CARBON MONOXIDE IN THE BREATHING GAS OF DIVERS Interim Report**

Joseph D. Bloom 12 Jun. 1970 16 p refs

(AD-721680; NAVMED-M4306.02-2110B-1; SMRL-629) Avail: NTIS CSCL 6/11

The literature on carbon monoxide toxicity is voluminous and growing. In environments of one atmosphere the short-term effects of various breathing gas mixtures and blood levels are fairly well defined as a function of exposure time. There is, however, incomplete data on which to base extrapolation of these limits to the hyperbaric environments or to evaluate the existence of long-term effects. The paper briefly reviews the rationale for the currently established standards, and discusses some of the newer considerations related to hyperbaric exposure. Author (GRA)

**N71-29359#** Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.

**MAXIMUM PERMISSIBLE LIMITS OF CONTAMINANTS FOR DIVERS BREATHING GAS: AN OVERVIEW Interim Report**

Joseph D. Bloom 12 Jun. 1970 11 p

(AD-721681; NAVMED-M4306.02-2110B-2; SMRL-631) Avail: NTIS CSCL 6/11

Navy biomedical research strives to establish limits of contamination of breathing gas tolerable to Naval personnel in operational settings. Customary steps in the determination of these limits include exposure of laboratory animals to the contaminant followed by observation of patterns of morbidity and mortality in these animals. This data is then extrapolated to humans under exposure conditions that may or may not be similar to those of the laboratory experiment. In addition to animal-human and time frame extrapolations, establishment of limits applicable to the hyperbaric environments must also consider the relevance of partial pressure increase and the possible synergism or antagonism among multiple contaminants. This paper elaborates on these steps in the chain of biomedical investigation of contaminant toxicity and the pertinent pitfalls associated with them. Author (GRA)

**N71-29383\*#** Lockheed Missiles and Space Co., Sunnyvale, Calif. **DESIGN, DEVELOPMENT, AND FABRICATION OF A WATER ELECTROLYSIS SYSTEM FOR A 90-DAY MANNED TEST Final Report**

B. M. Greenough and T. M. Olcott 21 Jun. 1971 98 p refs

(Contract NAS1-9728)

(NASA-CR-111911) Avail: NTIS CSCL 06K

A circulating electrolyte water electrolysis system, the electrolytic oxygen generator, was designed, fabricated, and operated. The generator was subjected to tests in which it operated successfully for 100 hours in a continuous, automatic, hands-off mode. The system has provisions for manual startup and shutdown,

automatic safety shutdown, and fault diagnosis and performance monitoring by means of front panel indicators. It features automatic control of water balance, temperature, differential pressure, and gas generation rate. The design oxygen generation capacity is 8 lb/day, at a discharge pressure of 21 to 27 psig. Hydrogen is discharged at 9 psig. The system operated successfully for 70 days and was required to furnish oxygen at rates up to 25 percent in excess of its design capability.

Author

**N71-29417#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

**TOXICOLOGY OF INHALED PLUTONIUM: EXPERIMENTAL ANIMAL STUDIES**

W. J. Bair 1970 43 p refs Presented at the Seminar on Radiation Protect. Probl. Relating to Transuranium Elem., Karlsruhe, West Ger., 21-25 Sep. 1970; sponsored by Euratom (Contract AT(45-1)-1830)

(BNWL-SA-3469; Conf-700930-2) Avail: NTIS

Results are reported from studies on dogs of the up-take and subsequent tissue disposition of several inhaled plutonium compounds including (Pu-239)O<sub>2</sub>, (Pu-239)(NO<sub>3</sub>)<sub>4</sub>, and (Pu-239)F<sub>4</sub> and several types of (Pu-239)O<sub>2</sub> and (Pu-239)O<sub>2</sub> aerosols of different particle size distributions. Plutonium dioxide calcined at 1000 C showed maximum retention, while Pu(NO<sub>3</sub>)<sub>4</sub> was cleared most rapidly from the lung. Of the PuO<sub>2</sub> aerosols, those composed of the smallest sized particles showed the greatest rate of clearance from the lung. Except for Pu(NO<sub>3</sub>)<sub>4</sub>, which translocated principally to bone and liver, the tracheobronchial lymph nodes accumulated the major fraction of plutonium translocated from the lung. Data from nearly 100 dogs, some followed for as long as 9 years, were used to develop a mathematical model for inhaled PuO<sub>2</sub> in dogs. The half-time for pulmonary retention of alveolar deposited plutonium was about 1000 days. Excretion was principally via the feces. Lymphopenia was the most consistent clinical observation in animals with lung burdens. Long-term effects include pulmonary neoplasia.

Author (NSA)

**N71-29437#** Southampton Univ. (England). Inst. of Sound and Vibration Research.

**EFFECTS OF NOISE UPON SLEEP**

P. A. Morgan Dec. 1970 91 p refs

(ISAV-TR-40) Avail: NTIS

The effects of auditory stimuli during sleep and the after effects of sleep deprivation and sleep interference with particular emphasis on the question of sonic boom exposure during sleep are examined. An experimental approach for future work on the effects of sonic booms on sleep is proposed including methods of objective and subjective measurements of sleep interference. ESRO

**N71-29444#** Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.

**EFFECT OF A SUBMARINE PATROL ON VISUAL PROCESSES Interim Report**

S. M. Luria, Harris Newmark, III, and Hugh Beatty 14 Sep. 1970 16 p refs

(AD-721683; NAVMED-M4305.08-3001D-6; SMRL-641) Avail: NTIS CSCL 6/16

Two separate studies were undertaken to see if any measurable deterioration in basic visual processes occurred during one submarine patrol. There was no significant decline in acuity, stereoacuity, or refractive power, but there was a significant increase in near esophoria. This was consistent with long term effects reported previously. The results are discussed and suggestions made for future research. Author (GRA)

**N71-29479#** Biotechnology, Inc., Falls Church, Va.  
**FORECAST OF HUMAN FACTORS TECHNOLOGY ISSUES  
 AND REQUIREMENTS FOR ADVANCED  
 AERO-HYDRO-SPACE SYSTEMS** Final Report

Harold E. Price and James F. Parker, Jr. Mar. 1971 355 p  
 refs

(Contract N00014-69-C-0327)

(AD-721713) Avail: NTIS HC\$6.00/MF\$0.95 CSCL 5/5

Three major new systems planned for the 1970s have been examined: the supersonic transport, the space shuttle, and undersea systems, covering both underwater habitats and deep sea submersibles. The operation of these systems and the proposed utilization of man within each system have been described in detail. Specific issues relating to the use of man have been discussed. Finally, research requirements have been recommended that should receive emphasis if appropriate human factors and biomedical technology is to be developed to support the full spectrum of advanced systems to be developed within the next decade.

Author (GRA)

**N71-29540#** Joint Publications Research Service, Washington, D.C.

**EXPERIMENT ON COMPUTER PROGRAMMING OF  
 INFLUENZA EPIDEMIC**

L. A. Rvachev. In *its* Cybernetics and Regulation Theory 18 Jun. 1971 p 18-20 refs

Avail: NTIS

The simulation of an influenza epidemic spreading over a vast territory from a single city is described. The formulas are based on the population of the initial city, the number of infected persons, the number of nonimmunized persons, the maximum duration of illness, the probability of remaining ill for a given time after the onset of the disease, the average frequency of intracity transmission of the infection, and the number of persons that moved from the initial city to another city per unit of time. Data was fed to the computer from the actual epidemic beginning in Leningrad in early January 1965 and spreading to Moscow during the end of January and February. The simulation was extended to 23 other cities for which statistical data are available. The agreement between the sets of data indicate that epidemic growth can be simulated.

N.E.N.

**N71-29560#** Human Engineering Labs., Aberdeen Proving Ground, Md.

**SCHEMA LEARNING AND UTILIZATION AS A FUNCTION  
 OF TASK AND STIMULUS VARIABLES**

Chris T. Bersted, Bill R. Brown, and Selby H. Evans Dec. 1969 27 p refs

(AD-701184; TM-22-69) Avail: NTIS

Two experiments were conducted to evaluate the effects of constraint redundancy shifts, length of rest interval and duration of intertask interval upon the acquisition and transfer of schematic concepts. The first study indicated that increasing the magnitude of stimulus redundancy in a simple discrimination task facilitates schematic concept formation (SCF), but that the redundancy variable interacts with length of the rest interval administered prior to the redundancy shift. Transfer of SCF from a discrimination task to a modified reproduction task following a variable intertask interval was demonstrated in the second experiment; this demonstration, however, required the use of an extremely sensitive dependent measure. The results from the two studies complement each other in that they indicate hypothesis shifting by Ss. rather than fatigue or boredom, to be the primary basis for both the variable performance and the small positive transfer in schematic concept formation tasks.

Author

**N71-29561#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

**AN ELECTROROENTGENOGRAPHIC METHOD OF  
 INVESTIGATION IN DIAGNOSING DISEASES OF THE  
 CARDIOVASCULAR SYSTEM AND RESPIRATORY ORGANS**

N. R. Paleyev 25 Sep. 1969 13 p refs Transl. into ENGLISH

from Sov. Med. (USSR), no. 11, 1968 p 22-26

(AD-700296; FTD-MT-24-219-69) Avail: NTIS

The first experiment in applying the electroroentgenographic method of investigation to diseases of the respiratory organs and cardiovascular system have indicated its diagnostic value. The method possesses important technical merits and is very economical. It is expedient to use this method extensively in hospital and polyclinical practice. Electroroentgenography can be used as a method of roentgenographic control during surgical operations.

Author

**N71-29636#** Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

**TOLERANCES OF THE HUMAN BRAIN TO CONCUSSION**

John J. Swearingen Mar. 1971 7 p refs

(FAA-AM-71-13) Avail: NTIS

The pertinent literature and additional evidence indicating that the human brain may be able to tolerate head impact forces in the range of 300 to 400 g's without evidence of concussion or other detectable neurologic sequelae, is reviewed. Provisions to prevent deformation of the cranium are stipulated.

Author

**N71-29637#** Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

**EFFECTS OF CONFLICTING AUDITORY STIMULI ON  
 COLOR-WORD INTERFERENCE AND AROUSAL**

Richard I. Thackray and Karen N. Jones Mar. 1971 11 p refs

(FAA-AM-71-7) Avail: NTIS

Male subjects were tested to determine whether the interference effect produced by the Stroop color word test might be enhanced through the use of simultaneously presented, conflicting auditory stimuli. When instructed to respond only to the hue of visually presented color words printed in incongruent inks, neither task-related (conflicting color names) nor task-unrelated (random numbers) auditory stimuli resulted in any increase in the Stroop interference effect, and there were no indications of an increase in autonomic indices of arousal. It was concluded that the use of simultaneous auditory stimuli contribute nothing additional to the basic Stroop test in terms of either task interference or level of arousal.

Author

**N71-29638#** Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

**EFFECTS OF LOW-GRADE HYPOXIA ON PERFORMANCE  
 IN A VIGILANCE SITUATION**

Vincent Fiorica, Mary Jo Burr, and Russell Moses Mar. 1971 12 p refs

(FAA-AM-71-11) Avail: NTIS

Forty male subjects participated in a study to examine the relationship between low grade hypoxia and vigilance performance. At an altitude equivalent of 11,500 feet in a low pressure chamber, subjects without supplemental oxygen did not respond differently from well oxygenated subjects at the same altitude with respect to such physiologic measures as heart rate, respiratory frequency, internal body temperature, or plasma concentrations of glucose or lactate. Nor were these measures significantly different between groups studied at altitude and ground level controls. The only evidence of hypoxia observed in the altitude/room air group was

a decrease in blood oxygen saturation measured with an earpiece oximeter. Vigilance performance deteriorated with time in all groups. No significant differences, however, could be detected between the hypoxic group and the well oxygenated groups. Author

**N71-29639#** Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

**ASSESSMENT OF A STRESS RESPONSE SET IN THE COMPOSITE MOOD ADJECTIVE CHECK LIST**

Roger C. Smith Apr. 1971 22 p refs

(FAA-AM-71-14) Avail: NTIS

The effects of response sets to emphasize the appearance of stress in Composite Mood Adjective Check List (CMACL) records was investigated. Responses of 79 subjects asked to simulate stress, and 80 subjects asked to simulate stress in a subtle manner, were compared to CMACL responses obtained under normal conditions. A six word index was developed which was successful in identifying 95 per cent of the simulated profiles, while misclassifying only 12 per cent of the non-simulated, or authentic, profiles. The application of the index to clinical and research settings in aviation was discussed. Author

**N71-29640#** Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

**PROTECTIVE SMOKE HOOD STUDIES**

Ernest B. McFadden and Roger C. Smith, eds. Dec. 1970 67 p refs

(FAA-AM-70-20) Avail: NTIS

Evaluation and testing of a high-temperature resistant, transparent, polyimide hood designed to protect aircraft passengers and crew from the effects of toxic fumes, smoke and flame resulting from an aircraft accident are described. The hood was developed to provide protection of the respiratory system and maintain the occupant in a conscious and mobile state so that the aircraft can be evacuated before smoke and high temperatures render the cabin environment uninhabitable. The general smoke hood concept is examined with respect to environmental protection, vision, hearing, safety briefings, and the effect of the hood upon evacuation efficiency. Author

**N71-29682#** School of Aerospace Medicine, Brooks AFB, Tex. **LONG-TERM AIRCREW EFFECTIVENESS (A LITERATURE STUDY)**

George K. Cantrell, Ralph W. Trimble, and Bryce O. Hartman Apr. 1971 15 p refs

(AD-722417; SAM-TR-71-4; SAM-REVIEW-1-71) Avail: NTIS CSCL 6/19

A wide range of factors related to long-term aircrew effectiveness are discussed in this review. The major categories are work environment factors, task factors, personal factors in screening, and personal factors in development. The review identifies such significant problems as gaps in the existing scientific literature and failure to consider interactions between the categories described. Author (GRA)

**N71-29685#** RAND Corp., Santa Monica, Calif.

**THE RELATIVE IMPORTANCE OF CONTRAST AND MOTION IN VISUAL TARGET DETECTION**

H. E. Petersen and D. J. Dugas Mar. 1971 38 p refs

(Contract F44620-67-C-0045; Proj. RAND)

(AD-722407; R-688-PR) Avail: NTIS CSCL 6/16

Results of a previous study (see AD-720 800) suggested that the effect of motion on detectability might be caused entirely by

contrast changes as the target moves over a complex background. The test documented in the present study, employing a television display and an artificial background, showed independent effects of both contrast and motion on target detectability. The effects can be accounted for by modifying the exponent in the detection probability function with a linear contrast term and a second-power velocity term. Single-fixation experiments confirmed a larger aperture for moving targets than for static targets, and also demonstrated a gradual increase in the fixation time required to detect a target as a function of its distance from the fixation point. Author (GRA)

**N71-29763\*#** Massachusetts Inst. of Tech., Cambridge. **UNIVERSITY ROLE IN ASTRONAUT LIFE SUPPORT SYSTEMS: MONITORING ATMOSPHERIC CONTAMINANTS**

H. L. Galiana Washington NASA Jul. 1971 58 p refs

(Grant NGR-22-009-312)

(NASA-CR-1826) Avail: NTIS CSCL 06K

The state of the art in monitoring techniques for biological and chemical atmospheric contaminants is discussed. Brief reference is made to currently accepted allowable contaminant concentrations. An attempt is made to point out areas where there is a need for more research especially suited to graduate school laboratories. Such research should prove invaluable when extended from space capsule to Earth pollution problems. Author

**N71-29794#** Human Engineering Labs., Aberdeen Proving Ground, Md.

**A PROPOSED LIMIT FOR PRINTED-CIRCUIT BOARD INSERTION FORCES**

R. Bradley Randall Mar. 1971 13 p refs

(AD-723049; HEL-TN-2-71) Avail: NTIS CSCL 5/5

A study was made to recommend a maximum force level that an individual inserting printed circuit boards (PCBs) into equipment by pushing with his thumbs would not have to exceed to fully seat the PCB. Twenty-four subjects pushed against a simulated circuit card with two handle orientations in each of two directions. Each subject exerted his maximum steady force for three to five seconds, and then lunged to achieve the greatest maximum force possible. A recommended limit of 25 pounds was calculated from the results. This value is achievable by 95.8 percent of the population using a steady push. By lunging, more than 99 percent of the population can exert a 25-pound force. Author (GRA)

**N71-29868#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

**TOXICOLOGY OF INHALED PLUTONIUM**

W. J. Bair In AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 697-720 refs

(Contract AT(45-1)-1830)

Avail: NTIS HC\$6.00/MF\$0.95

In a series of experiments over 14 years, several plutonium compounds (Pu-238O2, Pu-239O2, Pu-239F4, and Pu-239(NO3)4) were administered to beagle dogs by inhalation to define the disposition of plutonium in the body and the resultant biological responses at the cellular and organ levels. All compounds showed a relatively long residence time in the lung. Plutonium translocated from the lung to other tissues accumulated principally in the tracheobronchial-lymph-nodes and to a lesser extent in liver, abdominal lymph nodes, and bone. After several years, plutonium in the tracheobronchial lymph nodes of dogs comprised about 40% of the total PuO2 initially deposited in the alveolar lung. The biological effects observed in these studies included lymphopenia, cellular changes in lung and tracheobronchial lymph nodes, respiratory insufficiency, and pulmonary neoplasia, depending upon amount of plutonium inhaled. Author (NSA)

**N71-29869#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

**A DYNAMIC SIMULATION OF THE RETENTION AND TRANSLOCATION OF INHALED PLUTONIUM OXIDE IN BEAGLE DOGS**

Bruce O. Stuart, Paul J. Dionne, and William J. Bair *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 721-737 refs

(Contract AT(45-1)-1830)

Avail: NTIS HC\$6.00/MF\$0.95

A dynamic simulation model for the biological disposition of inhaled plutonium oxide was developed using hybrid computer techniques. Tissue, blood, and excretion data collected from more than 60 beagle dogs up to 8.5 years after single inhalation exposures to Pu-239O<sub>2</sub> were incorporated into a program that predicts the long-term retention and translocation of inhaled insoluble plutonium. The dynamic simulation fitted to the accumulated data shows 10% of the plutonium initially deposited in the pulmonary lung remains at 12 years after exposure; the majority of this material follows a 4-year retention half-time. At 15 to 20 years after exposure the tracheobronchial lymph nodes, liver, and skeleton burdens plateau at 55%, 16%, and 6% of the plutonium deposited in the pulmonary lung.

Author (NSA)

**N71-29882#** Harvard School of Public Health, Boston, Mass. **PSYCHOLOGICAL FACTORS IN SOLAR OBSERVING Final Report, 20 Jan. 1968 - 19 Jan. 1971**

Ronald M. Pickett 1 Apr. 1971 30 p refs

(Contract F19628-68-C-0150)

(AD-722471: AFCRL-71-0166) Avail: NTIS CSCL 5/10

The report summarizes the aims of a 3-year program of work concerned with psychological factors in solar observing. Part I identifies several psychological factors which may affect solar observing and outlines a program of research. Part II is a report of a program of studies dealing with the application of visual perceptions in solar flare prediction.

Author (GRA)

**N71-29900\*#** Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

**STUDY OF THE EFFECTS OF THE DOPPLER SHIFT ON PERCEIVED NOISINESS**

Karl S. Pearsons, Ricarda Bennett, and Sanford Fidell Washington NASA Jul. 1971 53 p refs

(Contract NAS1-9427)

(NASA-CR-1779) Avail: NTIS CSCL 05E

Subjective judgments of the effects of Doppler shifts on perceived noisiness were made by 20 college students in an anechoic chamber. The stimuli heard in the tests included both recorded and simulated aircraft flyovers. Computer controlled generation of the simulated flyovers permitted independent variation of the source frequency, apparent altitude, amplitude, and Doppler patterns. Data collection was governed by a computer based adaptive technique known as parameter estimation by sequential testing (PEST). The major finding was that effective perceived noise level (EPNL) is a fairly accurate predictor of noisiness of flyovers containing Doppler shifts; except perhaps at altitudes of less than 500 feet, for which flyovers it underestimates apparent noisiness. Compensation for the rise time of the stimuli (an onset correction) did not improve the accuracy of prediction provided by effective perceived noise level. The frequency of pure tone components in the stimuli did not influence the subjects' judgments.

Author

**N71-29903\*#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

**EVALUATION OF STORABLE PROPELLANT REFORMING FOR USE IN EMERGENCY LIFE SUPPORT SYSTEM DESIGN**

Lyle O. Wright Washington Jul. 1971 35 p refs

(NASA-TM-X-2321: E-5520) Avail: NTIS CSCL 06K

The storable propellants Aerozine-50 and nitrogen tetroxide (N<sub>2</sub>O<sub>4</sub>) are evaluated as sources of hydrogen, oxygen, potable water, and heat for use in an emergency life support system. Results of these laboratory studies indicate the feasibility of steam reforming Aerozine-50 to obtain hydrogen rich gas. This gas was then processed through a palladium-silver diffusion cell to yield 99.99 percent pure hydrogen. Oxygen was obtained through reforming N<sub>2</sub>O<sub>4</sub> to yield an oxygen rich gas containing nitrogen and residual N<sub>2</sub>O<sub>4</sub>. The N<sub>2</sub>O<sub>4</sub> was removed by molecular sieves to yield a 67 percent oxygen - 33 percent nitrogen gas product. The data for these processes were used to estimate the volume and weight of several conceptual emergency life support systems. Comparisons were then made with life support system concepts which involved other hydrogen and oxygen sources. These sources were hydrogen peroxide and cryogenic oxygen for the oxygen supply; hydrazine reforming and cryogenic hydrogen were considered for the hydrogen supply.

Author

**N71-30126\*#** Baylor Univ., Houston, Tex.

**DEVELOPMENT AND TESTING OF A PROTOTYPE OPERATIONAL SYSTEM FOR AUTOMATIC MONITORING OF SLEEP DURING MANNED SPACE FLIGHT Final Report**

James D. Frost 31 May 1971 58 p refs Prepared in cooperation with Methodist Hospital, Houston, Tex.

(Contract NAS9-10747)

(NASA-CR-115071) Avail: NTIS CSCL 06B

A prototype operational system for automatically monitoring sleep during manned space flight was constructed and tested. A number of prototype assemblies which accomplished acquisition of EEG, EOG, and head-motion activity, analysis of data to provide an automatic indication of sleep states, and display of the results over time were incorporated into the operational system with various degrees of modification. The resultant prototype has been evaluated in terms of its overall suitability for use in a space-flight situation. Acquisition of EEG and EOG signals is accomplished by utilization of prefilled sponge-type electrodes incorporated into a disposable elastic cap. A preamplifier and accelerometer assembly unit is attached to the recording cap during use and provides initial amplification for the EEG and EOG activity. A dual-axis accelerometer is included and provides information regarding lateral and vertical head movements to the analysis circuitry for use in artifact discrimination. The EEG, EOG, and head-motion signals are processed by the automatic onboard equipment to provide an output signal representative of the subject's current sleep status. The output is provided in a form suitable for telemetry at a low sample rate.

Author

**N71-30127#** Flying Personnel Research Committee, London (England).

**A LABORATORY COMPARISON OF THREE METHODS OF PERSONAL CONDITIONING**

J. R. Allan, M. F. Allnutt, M. Beeny (RAE, Farnborough, England), R. de G. Hanson, J. Morrison et al Jan. 1971 43 p refs Prepared in cooperation with RAE, Farnborough, England

(FPRC-1307) Avail: NTIS

Twelve subjects were used to obtain comparative data between a water cooled, a convective air cooled, and a reverse flow air cooled personal conditioning system during laboratory simulations of a typical operational sortie in a hot climate. The results generally favored the water cooled system on physiological, behavioral and subjective grounds. The results of this laboratory trial may not

necessarily transfer to realistic operating conditions and further field testing, both in flight and using appropriate ground equipment is required before it can be shown whether these advantages can be realised.

Author

**N71-30140\*#** Techtran Corp., Glen Burnie, Md.

**THE DYNAMICS OF THE ELECTROENCEPHALOGRAM DURING SLEEP IN MAN UNDER NORMAL AND DAILY REGIMES [DINAMIKA ELEKTROYENTSEFALOGRAMMY VO VREMAY SNA CHELOVEKA PRI OBYCHNOM I IZMENENNYKH SUTOCHNYKH REZHIMAK]**

A. N. Litsov Washington NASA Jul. 1971 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 4, Jul. - Aug. 1970 p 521-529

(Contract NASw-1695)

(NASA-TT-F-13679) Avail: NTIS CSCL 06B

The electroencephalographic stages of sleep were studied in 28 healthy subjects under various regimes of sleep and wakefulness. During normal 24 hour regimes (sleep from 2300 to 0800) eight subjects showed typical electroencephalographic stages A, B, C, D, E, and PF, similarly described by other investigators under normal conditions. Orthodox sleep under this arrangement constituted 75-92% average per night, and paradoxical sleep constituted 8.3-36.1%. Moreover, the greatest expression of the paradoxical phase was most often observed in the early hours of the day. With a sudden change in the regime of sleep and wakefulness (in 8 subjects with sleep from 0500 to 1400 hours, and in 12 from 1400 to 2300 hours) the disturbed in the qualitative (predominance of the stages of superficial sleep) as well as in the quantitative (diminution of its duration) relationship. When the subjects remained under variable regimes there was a gradual improvement in sleep and in the qualitative and quantitative relationships. A more rapid improvement in sleep came with the first move of the regime (sleep from 0500 to 1400 hours), slower during the second move of the regime (sleep from 1400 to 2300 hours).

Author

**N71-30150#** Joint Publications Research Service, Washington, D.C.

**EFFECT OF PROLONGED EXPOSURE TO A HYPEROXIC GASEOUS MIXTURE ON THE HUMAN RESPIRATORY SYSTEM**

N. A. Agadzhanyan et al 10 Jun. 1971 9 p refs Transl. into ENGLISH from Patol. Fiziol. i Eksperim. Terapiya (Moscow), no. 2, 1969 p 46-49

(JPRS-53332) Avail: NTIS

Results are presented for an experiment in which two human subjects remained ten days in a specially equipped pressure chamber filled with a gaseous mixture containing 50 to 56% oxygen under ground conditions ( $pO_2 = 400$  mm Hg). The hyperoxic atmosphere produced a slight increase in the minute ventilation,  $O_2$  utilization, and partial pressure of oxygen in alveolar air without significantly affecting the  $CO$  diffusion capacity of the lungs. This demonstration of man's ability to remain for ten days under such conditions can be used as the physiological basis for determining oxygen conditions in inhabited airtight cabins, marine sports, and clinical medicine.

Author

**N71-30175\*#** National Aeronautics and Space Administration, Washington, D.C.

**CORN BLIGHT WATCH EXPERIMENT**

20 Jul. 1971 45 p

(NASA-News-Release-71-129) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 02C

The 1971 NASA, USDA, and Corn Belt States ground and air study of southern corn leaf blight is summarized. The surveillance aircraft and equipment are described as well as the ground based equipment. Operational and data reduction procedures are included for Illinois, Indiana, Iowa, Minnesota, Missouri, Nebraska, and Ohio.

J.M.

**N71-30186#** Kansas Univ., Lawrence. Dept. of Psychology.  
**THE DIFFERENTIAL EFFECTS OF FINE AND GROSS BODILY MOVEMENTS UPON VISUAL ADAPTATION TO PRISM PRODUCED TILT**

Gayle Rae Wheeler (Ph.D. Thesis) Oct. 1970 171 p refs

Avail: NTIS

The degree to which various types of movement promote visual adaptation to optical tilt was investigated. A comparison was made between walking in a hallway during prism exposure and visually guided arm movement during exposure. In order to determine how much visual adaptation was due to viewing two widely different environments, a comparison was made of two viewing conditions in which only head and eye movements occurred. Optical rearrangement in both studies was produced by prisms that tilted the field, mounted monocularly on safety goggles.

Author

**N71-30218#** Yale Univ., New Haven, Conn. Dept. of Administrative Sciences.

**MAN-COMPUTER INTERACTION IN A DECISION MAKING**

**ENVIRONMENT Annual Report, 1 Feb. 1970-31 Jan. 1971**

Robert B. Fetter Mar. 1971 57 p refs

(Contract N00014-67-A-0097-0010)

(AD-722336; AR-1) Avail: NTIS CSCL 5/2

An experiment was formulated, conducted, and results reported involving video and teletype consoles in an information retrieval environment. In conjunction with the development of an information system, a capability to simulate a variety of problem solving environments and automatically evaluate results was designed and programmed. This included the ability to give users on-line feedback of their relative effectiveness. Basic information relevant to further research was gathered, including: a bibliography of research in man-computer interaction; and a file of information on available computer consoles.

Author (GRA)

**N71-30219#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**CHROMATIC PATTERN RECOGNITION**

Charles W. Blackford, Jr. (M.S. Thesis) Mar. 1971 54 p refs

(AD-722853; GE/BE/71-4) Avail: NTIS CSCL 6/4

An achromatic pattern recognition model is modified to process chromatic objects. The theory of color television is used to obtain pattern information in terms of one luminosity and two opponent chromaticity functions. Two-dimensional Fourier transformations of the two color functions are performed. Color identification is then made by correlation with transform prototypes of colored chips previously derived and stored. The object is identified in a similar manner by transforming its luminosity function. A digital simulation of the model is conducted using the English alphabet and 84 colors representative of the color spectrum. All letters and their colors are successfully identified, including conditions where pattern brightness varies. Characters were also identified when the chromaticity varied. It is concluded that the modified model can be trained to identify any objects color.

Author (GRA)

**N71-30234#** Naval Ship Systems Command, Washington, D.C.  
**PROCEEDINGS OF US NAVY HUMAN RELIABILITY WORKSHOP**

James P. Jenkins Feb. 1971 343 p refs Conf. held at Washington, D.C., 22 - 23 Jul. 1970  
 (AD-722689; NAVSHIPS-0967-412-4010) Avail: NTIS CSCL 5/5

Overview of Project W 43-13 X human factors engineering technology Criteria for development of human reliability methodology. Some recent efforts toward the development of a human performance reliability data system and supportive human performance reliability principles. Development of a human error rate data bank. Quantification of human performance reliability research method rationale. Man-machine modeling-some current deficiencies and future needs. Reliability and independence. Developing a human reliability prediction method. A human performance data bank for command control and the progressive inference approach to development of data resources for predicting human reliability.

GRA

**N71-30238#** Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

**CLOTHING AVIATION Final Report**

19 Mar. 1971 35 p refs  
 (AD-723030; MTP-7-2-087) Avail: NTIS CSCL 15/5

The document provides test methodology and testing techniques necessary to determine the technical performance and safety characteristics of aviation tools and associated accessories as described in Materiel Needs (MN) and to determine the items suitability for service tests. Author (GRA)

**N71-30254#** Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

**PERSONNEL TRAINING Final Report**

15 Mar. 1971 13 p  
 (AD-723032; MTP-7-3-501) Avail: NTIS CSCL 5/9

The document provides methods and techniques used to train and familiarize Aviation Test Board personnel with aviation equipment, subsystems, systems, and related accessories which are to undergo service testing. Methods are provided for the evaluation of training programs, personnel skill levels, and the proficiency required to adequately prepare, operate, and maintain designated aviation materiel during conduct of the service test. Author (GRA)

**N71-30290\*#** Research Triangle Inst., Durham, N.C.

**NASA APPLICATION TEAM PROGRAM: APPLICATIONS OF AEROSPACE TECHNOLOGY IN BIOLOGY AND MEDICINE**

Semiannual Report, Oct. 1970 - Mar. 1971  
 1971 121 p  
 (Contract NASw-1950)

(NASA-CR-119181) Avail: NTIS CSCL 06E

The accomplishments of the application team are reported. The team has identified 52 new problems for investigation, has accomplished 4 technology applications and 13 potential technology applications, has closed 49 old problems, has reactivated 2 old problems, and on March 31, 1971, had a total of 86 problems under active investigation. Rehabilitation medicine; mental health; detection and treatment of heart, kidney, cancer, and respiratory diseases; artificial organs; health care cost reduction; improved surgical procedures; basic medical research; and miscellaneous problems are summarized. Author

**N71-30391#** Joint Publications Research Service, Washington, D.C.

**SYSTEMS RESEARCH**

16 Jun. 1971 30 p ref Transl. into ENGLISH of the book "Sistemnyye Issledovaniya" Moscow, Nauka Publ. House, 1970 p 114 - 133  
 (JPRS-53376) Avail: NTIS

Excerpts of philosophical discussions on the systemic analysis in ecology are presented. The importance of tropic links in a biocenosis is examined, and the problems of how to differentiate a system from surrounding subjects and which elements should be included in a biocenosis are considered. The difficulties in deciding the size of ecosystems to study (zooids, populations, or communities) are described, along with the type of result in each situation. The development of the systemic approach in ecology is traced from the organism-medium basis, to extending biocenosis to biogeocenosis, and trophodynamic systems with sensory links added. Problems associated with the qualitative analysis of ecological links are identified as the quantitative description in concepts dealing with the transfer of material, energy, or information, and the description of the structure of ecological systems. N.E.N.

**N71-30401\*#** Martin Co., Baltimore, Md. Space Systems Div.

**PILOT COMPARTMENT AIRBAG RESTRAINT PROGRAM Final Report**

Carl C. Clark, Carl Blechschmidt, and Fay Gordon Jul. 1964 85 p refs

(Contract NASw-877)

(NASA-CR-60169; ER-13551) Avail: NTIS CSCL 06K

Manned impact tests of airbag restraint systems in a preliminary experimentation box, a spacecraft simulator, and a passenger airplane simulator were carried out to show the feasibility of such active elastic restraint systems, in which restoring forces can be varied by varying bag pressures to ensure the prevention of bottoming. Analog simulation of the airbag restraint system duplicated the experimental vertical drops and allowed predictions beyond the experimental effort. The system has a resonant frequency of 2.05 cps with a transmissibility of 4.8 at resonance. The analog model permitted solution of typical launch and reentry as well as impact loads. Indications from both the experimental program and the analog program are that the airbag-type restraint system would provide excellent isolation from spacecraft landing impacts and launch and reentry vibrations with the astronaut in any attitude. The study also led to the development of an active elastic airbag restraint system for aircraft passenger protection. Author

**N71-30447#** Grenoble Univ. (France). Faculte des Sciences.  
**USE OF THE GRENOBLE HIGH FLUX REACTOR IN BIOLOGY [UTILISATION DU REACTEUR A HAUT FLUX DE GRENOBLE EN BIOLOGIE]**

Emile D. Duee (Ph.D. Thesis) 1970 24 p refs In FRENCH  
 (NP-18462) Avail: AEC Depository Libraries

After some remarks on the subject of neutron diffraction, with special reference to biological uses, the possibilities of applying this method to the determination of protein structure are examined on the basis of already published experimental results. Because of the nondestructive nature of neutrons for proteins, neutron diffraction is an ideal method for the study of proteins of high molecular weight which are difficult to crystallize and very sensitive to X rays. The advantages of the equipment foreseen for the Grenoble high flux reactor are discussed. Author (NSA)

**N71-30448#** Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

**STUDY OF CLOTHES PROVIDING EFFECTIVE TRITIUM**



**PROTECTION [ETUDE D'UN SCAPHANDRE EFFICACE VIS-A-VIS DU TRITIUM]**

Pierre Marteau Feb. 1971 52 p refs In FRENCH  
(CEA-N-1413) Avail: AEC Depository Libraries

The manufacture of individual clothes providing maximum protection against tritium and tritiated water vapor was studied. A review of the properties of tritium, its biological effects and the hazards it presents, was made. A thorough investigation of the various polymerized and rubberized materials suitable for making such clothes was carried out. A protective suit of original design, made of the material found to be the most effective in view of the mechanical resistance criteria imposed, was manufactured and tested. Since tritium and tritiated water diffuse very easily through all materials, the use of such clothes may be extended to almost all substances which present chemical or radioactive hazards.

NSA

**N71-30598#** Royal Swedish Academy of Engineering Sciences, Stockholm.

**BORON FROM AN ENVIRONMENTAL POINT OF VIEW [BOR FRAEN MILJOESYNPUNKT]**

1970 25 p refs In SWEDISH  
(IVA-33) Avail: NTIS

By comparison of previous measurements of boron content in river-, lake-, or sea water with today's knowledge of the same, it has been possible to identify the effect of the increase of boron in effluents, on green plants, and human beings. It appears that from the data so far available on the boron content in nature, boron and its pollution does not constitute an acute problem for the environment. However, a number of actions are recommended such as the investigation of the minimum toxic dose for green plants and for human beings, the average increase of boron in effluents, etc.

ESRO

**N71-30599#** Royal Swedish Academy of Engineering Sciences, Stockholm.

**PLASTICS SEEN FROM AN ENVIRONMENTAL POINT OF VIEW [PLASTER FRAEN MILJOESYNPUNKT]**

1969 15 p In SWEDISH  
(IVA-Medd-160) Avail: NTIS

Combustion of waste products causes, due to their atmospheric corrosion, a great problem for their disposal. It is discussed under what conditions it is best to dispose of plastic waste material.

ESRO

**N71-30662\*#** Sandia Corp., Albuquerque, N.Mex. Planetary Quarantine Dept.

**PLANETARY QUARANTINE PROGRAM Quarterly Progress Report, Period Ending 30 Jun. 1971.**

30 Jun. 1971 80 p Sponsored in part by AEC  
(NASA Order W-12853)  
(NASA-CR-119314; QPR-21) Avail: NTIS CSCL 06M

Activities in the Planetary Quarantine Program are reported. During this period, emphasis was placed on evaluating the problem of the recently discovered hardy soil spores in spacecraft sterilization. As a result, it was recommended that sterilization cycles be based on the estimated actual distribution of resistance among organisms. Other activities reported include: thermoradiation experiments and modeling, the effects of relative humidity on particle adhesion to surfaces, removal of organisms from dust particles, and bacterial spore inactivation.

F.O.S.

**N71-30663\*#** Public Health Service, Phoenix, Ariz. Applied Microbiology and Planetary Quarantine Section.

**SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, APRIL-JUNE 1971**

Martin S. Favero Jun. 1971 25 p  
(NASA Order W-13062)

(NASA-CR-119313; Rept-34) Avail: NTIS CSCL 06M

The research in microbiology for planetary quarantine is reported. As a result of tests conducted with inexperienced individuals using the swab-rinse technique, it was concluded that the experience and training of the individual collecting the sample is not a significant variable in the recovery of microorganisms. Experiments were conducted which show that the fraction of *Bacillus subtilis* spores in methyl methacrylate that survive grinding in the biotest grinder is very small. Other activities reported include the identification of 1123 microorganisms isolated from the Apollo 14 spacecraft, and the evaluation of a terminal sterilization process for unmanned lander spacecraft.

F.O.S.

**N71-30670\*#** Stanford Research Inst., Menlo Park, Calif.  
**DISTURBANCE OF HUMAN SLEEP BY SUBSONIC JET AIRCRAFT NOISE AND SIMULATED SONIC BOOMS**

Jerome S. Lukas, Mary E. Dobbs, and Karl D. Kryter Washington  
NASA Jul. 1971 68 p refs

(Contract NAS1-9286)  
(NASA-CR-1780) Avail: NTIS

Four subjects in each of three age groups (young - about 7 years of age, middle age - about 51 years, and old - about 71 years of age) were exposed for 20 nights to simulated sonic booms and subsonic jet flyover noises. Four intensities of each stimulus were usually presented twice each night. The results show that the children were relatively unresponsive to the booms or the flyover noise regardless of intensity. The middle-aged men were behaviorally awakened by about 18 percent of the booms and by about 18 percent of the flyover noises. The older men, in contrast, were awakened by about 32 percent of the booms and to about the same extent by flyover noises. Two subgroups of relatively low and high sensitivity to noise during sleep were found in both the middle-aged and old groups.

Author

**N71-30671\*#** Scripta Technica, Inc., Washington, D.C.  
**THERMOPHILIC BACTERIA [STUDIEN UEBER THERMOPHILE BACTERIEN]**

V. Opreacu NASA Jun. 1971 20 p refs Transl. into ENGLISH from Arch. Hyg. Bakteriell. (Munich), v. 33, 1898 p 164-186  
(Contract NASw-2036)

(NASA-TT-F-13795) Avail: NTIS CSCL 06M

An attempt is made, for identification purposes, to determine the properties of thermophilic bacteria. Particular attention is given to zymogenesis and enzymosis. Results are given in tabular form.

E.H.W.

**N71-30751\*#** National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.  
**ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM (EC/LSS) FOR THE MODULAR SPACE STATION (OPTION 4)**

Hubert B. Wells and Andrew G. Kromis 15 Feb. 1971 52 p  
(NASA-TM-X-64603) Avail: NTIS CSCL 06K

The major parameters selected for comparison were logistics, assembly weights, power, and cost. The EC/LSS used for comparison is capable of supporting a six man crew continuously over an extended period of time with regular resupply. Nominal crew rotation and resupply were considered to be on a 90-day

cycle. The EC/LSS must maintain a system life requirement of 10 years through maintenance, spares, and redundancy. The pre-phase A type investigation included open loop, partially closed loops, and full closure of both the oxygen and water cycles. The selected EC/LSS approach is a partially closed water loop and an open oxygen loop. Author

**N71-30795\***# General Electric Co., Philadelphia, Pa. Re-Entry and Environmental Systems Div.

**METHODS OF RESEARCH ON INFECTIOUS DISEASE IN SPACEFLIGHT. A PRELIMINARY STUDY OF APPLICATION OF BIOSATELLITE TECHNIQUES TO STUDIES OF INFECTIOUS DISEASE PROCESSES**

James J. Shull 17 Feb. 1971 20 p refs

(Contract NASw-2073)

(NASA-CR-119243) Avail: NTIS CSCL 06E

The means selected to implement research on infectious disease in manned space flight are summarized. Recommendations for research are discussed including the physical behavior of infectious aerosols; microbial aerosol viability, longevity, and virulence; epidemiological studies; response to vaccines; long term space flight effects on local host defenses and specific immune mechanisms; repopulation of gastrointestinal flora; latent and slow virus infection in space flight; host factors affecting latent infection; changes in microbial flora; and isolation effects on susceptibility to infection. J.M.

**N71-30803\***# Translation Consultants, Ltd., Arlington, Va.

**THE ARTICULATORY FREQUENCY SPECTRUM AS AN INDICATOR OF THE DEGREE AND NATURE OF EMOTIONAL STRESS IN MAN [CHASTOTNYY SPEKTR RICHI KAK POKAZATEL STEPENI I KHAKTERA EMOTSIONALNOGO NAPRYAZHENIYA U CHELOVEKA]**

V. A. Popov et al Washington NASA Jul. 1971 10 p refs Transl. into ENGLISH from Zh. Vysshei Nervoi Deyelnosti (Moscow), v. 21, no. 1, 1971 p 104-109

(Contract NASw-2038)

(NASA-TT-F-13772) Avail: NTIS CSCL 05E

The results obtained using improved methods of estimating human emotional states by the changes in the frequency characteristics of his speech are outlined. The mean weighted frequency (centroid) of the spectrum was determined in model experiments on actors, as well as on cosmonauts during their flight in the Voskhod-2 spacecraft. The changes in the articulatory spectrum were compared with the heart rate. A study of the envelopes at the output of the five-channel octave frequency analyzer, in addition to estimating the degree of emotional stress, has made it possible to differentiate the positive (delight, joy) and negative (alarm, fear) emotional character of speech. The accuracy of determination is increased at high degrees of emotional stress. Author

**N71-30810#** Human Resources Research Organization, Alexandria, Va.

**SHAPE PERCEPTION JUDGMENTS AS A FUNCTION OF STIMULUS ORIENTATION, STIMULUS BACKGROUND, AND PERCEPTUAL STYLE**

Edward W. Frederickson Dec. 1970 62 p refs

(Contract DAHC19-70-C-0012)

(AD-722479; HumRRO-TR-70-24) Avail: NTIS CSCL 5/10

Two experiments tested the validity of the shape-slant invariance hypothesis. The first tests used two-dimensional rectangular stimuli to obtain shape judgment responses from 20 subjects. Individual differences between subjects were found to

significantly influence shape judgement, but stimulus shape did not. In the second experiment, 68 subjects judged the shape and rotational orientation of three-dimensional rectangular solids. A statistical procedure was used to control this source of variance. Shape and rotation of the stimulus objects were found to influence judgments of shape and rotational orientation. Errors of judging stimulus shape and rotation were significantly correlated, as were the objective and projective stimulus shapes. These later results were interpreted as providing support for the shape-slant invariance hypothesis. Author (GRA)

**N71-30811#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**PATTERN RECOGNITION MODEL BASED ON CORTICAL ANATOMY**

Willis O. Mahaffey (M.S. Thesis) Mar. 1971 122 p refs

(AD-722651; GE/EE/71-18) Avail: NTIS CSCL 6/4

The report presents material supporting a model for pattern recognition that closely approximates the connectivity evident in the neurons of the cerebral cortex. A computer simulation of the model was tested on three sets of patterns (letters and geometric figures) and the results show that pattern separation is generally the same as for a human. Author (GRA)

**N71-30826\***# National Aeronautics and Space Administration, Washington, D.C.

**PLANETARY QUARANTINE ANALYSIS FOR AN UNMANNED MARS ORBITER**

A. R. Hoffman (JPL), R. J. Reichert (JPL), N. R. Haynes (JPL), and L. B. Hall Jul. 1971 19 p refs Presented at the 14th Planetary Meeting of COSPAR, Seattle, Jun. 17-Jul. 2 1971

(NASA-TM-X-67238) Avail: NTIS CSCL 06M

The analysis approach and the planetary quarantine model being applied to the program for allocating and estimating the probability of contamination associated with potential biological contamination sources are described. It is shown that three sources, accidental impact of the spacecraft, loose particles, and gases used for attitude control and pressurization form the major hazards. The results of the analysis indicate that with the planned mission strategy, including aiming point and delivery biases, and the imposition of facility and procedural control during the systems test operations to minimize particulate and microbial contamination of the spacecraft, the planetary quarantine constraints for the Mariner Mars 1971 mission are being satisfied. Author

**N71-30840#** Royal Swedish Academy of Engineering Sciences, Stockholm.

**BIOCHEMISTRY AND BIOTECHNOLOGY, AN OUTLOOK TOWARDS THE YEAR 2000 [BIOKEMI OCH BIOTEKNOLOGI. EN UTBLICK MOT AER 2000]**

Goesta Ehrensvaerd In its Articles and Speeches at the Anniv. of IVA, 1919-1969 1969 p 62-81 In Swedish

Avail: NTIS; Esselte AB, Stockholm: 18 SKR

The many heart transplantations during recent years have made immunochemistry into a permanent research field. The question is raised whether biochemistry can help to reject antigens and antibodies, whether enzymes can solve pollution problems, and whether a human being can be connected to a computer. ESRO

**N71-30847\***# Ocean Systems, Inc., Tarrytown, N.Y. Research and Development Lab.

**RELATIVE DECOMPRESSION RISKS OF SPACECRAFT CABIN ATMOSPHERES: COMPARISON OF GASES USING MINIATURE PIGS Final Report**

R. W. Hamilton, Jr., B. P. Uberto, and G. F. Doebbler (Contract NAS2-5481) (NASA-CR-114355) Avail: NTIS CSCL 06K

The miniature pig was used as the animal model for the analysis of altitude decompression sickness and for determining the relative decompression hazards of various potential space-cabin atmospheres. By replicate decompressions of individual pigs after saturation exposure in the same and in different inert gas environments a relative ranking of five inert gas mixtures in terms of increasing severity of decompression hazard was made. The order of increasing risk for the gases studied was: neon < crude neon < helium < nitrogen < argon. In these experiments miniature pigs were saturated for 22 hours in a controlled environmental chamber at a pressure slightly greater than atmospheric (900 mm Hg). Individual pigs were decompressed in an oxygen environment to 105 mm Hg (46,000 feet altitude equivalent). Gases used were nitrogen, helium, neon, argon, and crude neon (a mixture of 75% neon and 25% helium obtained from air separation plants). Signs of decompression sickness were analyzed in terms of severity, time of occurrence, individual animal response, and reproducibility of response. Results were analyzed in terms of both a supersaturation limiting concept of decompression risk and the correlation of observed decompression risk for each gas with parameters of bubble growth characteristic of the gases. Reasonably good correlation between some bubble growth parameters and decompression sickness scores for the gases was found. Author

**N71-30856\*** Informatics Tisco, Inc., College Park, Md.  
**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 88)**  
Washington NASA Apr. 1971 103 p refs Sponsored by NASA (NASA-SP-7011(88)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

**N71-30867#** Joint Publications Research Service, Washington, D.C.

**BIOELECTRICAL CONTROL: MAN AND AUTOMATIC SYSTEMS**

21 Jun. 1971 69 p refs Transl. into ENGLISH from the book 'Riyelektricheskoye Upravleniye. Chelovek i Avtomaticheskoye Sistemy' Moscow, Nauka, 1970 p 501-546 and 557-573 (JPRS-53414) Avail: NTIS

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**N71-30868#** Joint Publications Research Service, Washington, D.C.

**DEVELOPING METHODS OF DESIGNING AND EVALUATING INFORMATION DISPLAY SYSTEMS**

D. I. Ageykin et al *In its Bioelec. Control: Man and Autom. Systems* 21 Jun. 1971 p 1-17 refs  
Avail: NTIS

New methods of designing and evaluating information display systems for industrial application are reviewed, and stages in developing the operator's work station in control systems are suggested. The following sequence of events is recommended for designing such stations: (1) determining preliminary distribution of control functions between the human operator and automatic devices; (2) compiling control algorithm tables; (3) compiling a tabular graph of events; (4) establishing a breakdown of events by categories of significance; (5) analyzing monitored parameters and choice of possible methods for determining their values; (6) analyzing control actions and their breakdown by type; (7) selecting information display methods; and (8) constructing and analyzing the first variant of the display system. In addition, the interaction between operator and machine in complex automatic control systems is briefly discussed, along with existing technical devices which facilitate operator functioning in various production situations. A.C.R.

**N71-30869#** Joint Publications Research Service, Washington, D.C.

**PRINCIPLES OF CONSTRUCTING COMPLEXES FOR CONTINUOUS MONITORING OF THE HUMAN ORGANISM AND AUTOMATIC NORMALIZATION OF ITS STATE**

V. M. Akhutin *In its Bioelec. Control: Man and Autom. Systems* 21 Jun. 1971 p 18-32 refs  
Avail: NTIS

Principles and methods of automatic, continuous monitoring of the psychophysiological condition of operators acting as a control link in a closed man machine system are discussed, with emphasis on biomedical situations. Techniques and problems of normalizing the operator's condition where necessary are also treated. Monitoring systems of the human operator's state have three inputs: data on slowly varying physiological parameters; data on rapidly changing biomedical situations supplied by a number of electronic recording devices; and information from psychological monitors for ongoing evaluation of the operator's state. Normalization methods include machine control of the operator's state, nonmachine control using contact devices, and nonmachine control in which contact juxtaposition with the operator is not required. A.C.R.

**N71-30870#** Joint Publications Research Service, Washington, D.C.

**ENGINEERING-PSYCHOLOGICAL PROBLEMS IN CONSTRUCTING LARGE SCALE SYSTEMS**

I. V. Yeremenko et al *In its Bioelec. Control: Man and Autom. Systems* 21 Jun. 1971 p 33-42 refs  
Avail: NTIS

The construction of large-scale automated control systems requiring contributions from a number of different fields is discussed, emphasizing that each task in the development stage involves solution of specific engineering-psychological problems. Specific

attention is given to theoretical considerations in designing operator activity in such systems. The process must include the following tasks: (1) determining place and role of the operator in different links and levels of control; (2) defining the functional duties of operators with different specialities; (3) psychologically analyzing operator activity; (4) identifying physiological and psychological requirements for operator input/output characteristics; and (5) constructing a psychological model of operator behavior. Solving these problems requires joint effort by systems analysts, engineering psychologists, mathematicians, and specialists in physical and biological cybernetics.

A.C.R.

**N71-30871#** Joint Publications Research Service, Washington, D.C.

**HEURISTIC ASPECTS OF THE PROBLEM 'MAN AND LARGE SCALE SYSTEMS'**

V. N. Pushkin *In its Bioelec. Control: Man and Autom. Systems* 21 Jun. 1971 p 43-55 refs.

Avail: NTIS

Heuristic aspects of the design and operation of large-scale man machine systems are discussed, emphasizing that heuristic activity forms the basis for solving problems and for formulating control strategies. Concepts and processes related to automatic control in such situations are treated, and the failure to fully appreciate the importance of creative thought and human interrelationships in operating controlled systems is criticized. Experimental psychological studies in formulating problem solving strategies are described, emphasizing that the construction of a dynamic information model is underlying requirement for analyzing human heuristic processes. Finally, the two components of thought in problem solving and the problem of distributing functions between man and machine during the design of large-scale systems are analyzed.

A.C.R.

**N71-30872#** Joint Publications Research Service, Washington, D.C.

**HEURISTIC DECISION-MAKING PROGRAMS**

A. V. Napalkov *In its Bioelec. Control: Man and Autom. Systems* 21 Jun. 1971 p 56-70 refs.

Avail: NTIS

Human capacity for decision making over a broad class of situations was investigated for the case when specific details in the approach to each information problem are given. The objective was to derive a complex set of programs representing different levels of heuristic activity. Integrated methods of investigation were used, and experimental study of brain functioning was combined with formulation of heuristic computer programs and development of theoretical models. Detailed descriptions are given of the methodology used in developing the programs, and analysis of the resulting models indicated that after instruction in solving problems of one or several classes, such computer programs are capable of solving other situations in the same class or finding solutions to unforeseen situations.

A.C.R.

**N71-30873#** National Defense Research Organization TNO, The Hague (Netherlands).

**THE REAL EAR ATTENUATION OF COM-FIT EARPLUGS [DE GELUIDVERZWAKKING VAN COM-FIT OORDOPJES, FABRIKAAT SIGMA ENG. CO.]**

A. M. Mimpfen and R. Plomp 1971 8 p In DUTCH; ENGLISH summary

(IZF-1971-4; TDCK-57386) Avail: NTIS

With five subjects the real-ear attenuation was determined for Com-Fit earplugs. These earplugs showed a good sound

attenuation particularly at frequencies important for hearing damages, although the standard deviations are considerable. Author

**N71-30937#** National Defense Research Organization TNO, The Hague (Netherlands). Inst. for Perception.

**DISORIENTATION IN AEROSPACE FLIGHT: A REVIEW OF EXPERIMENTAL STUDIES RELATING TO THE OCULOGRAVIC ILLUSION AND THE CORIOLIS EFFECT**

F. Phillip van Eyl 1970 13 p refs

(IZF-1970-25; TDCK-56755) Avail: NTIS

Literature on the oculogravic illusion and the Coriolis effect is reviewed. Conclusions indicate that there is a strong possibility that several physiological systems play a role, and that, particularly where Coriolis effect is concerned, experience leads to suppression of reactions to certain vestibular stimulation. Author

**N71-31040#** Institute for Perception RVO-TNO, Soesterberg (Netherlands).

**INTERNAL REPRESENTATION BY COMPLEX DYNAMIC PROCESSES [INTERNE REPRESENTATIES BIJ COMPLEXE DYNAMISCHE PROCESSEN]**

W. H. Janssen [1970] 54 p refs In DUTCH

(IZF-1970-21; TDCK-56713) Avail: NTIS

A survey of psychological and ergonomic investigation in the field of the so-called internal representations is given. The concept of internal representation, which is borrowed from the computer sciences, encloses amongst other things the field of metal imagery. The literature of various fields where IR seems to be important is examined for relevance to the theoretical and empirical development of the concept, notably for the as yet little studied situations in which an IR is based on external dynamics processes. It appears that relevant data from investigations on mental and eidetic imagery, amodal perception, perception of movement, associative memory structures and coding, paired-associate learning, anticipation and tracking, and cognitive schemes, are scarce. Author

**N71-31053#** National Inst. of Radiological Sciences, Chiba (Japan).

**[RADIOLOGICAL SCIENCES RESEARCH] Annual Report, 1969-1970**

Oct. 1970 87 p refs

(NIRS-9) Avail: AEC Depository Libraries

The National Institute of Radiological Sciences has several responsibilities in developing its research program: one of them is to advance the understanding of the effects of ionizing radiation on the human body, and another to develop beneficial applications of these radiations. To carry out the research works, the Institute has 11 departments grouped into the categories of physics and chemistry, biology and genetics, environmental study, and medicine. Programs for the peaceful use of atomic energy currently in progress include studies on internal exposure plutonium and studies on fundamental and clinical aspects of bone marrow transplantation.

Author

**N71-31077\*+ Informatics Tisco, Inc., College Park, Md. AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO A CONTINUING BIBLIOGRAPHY**

Washington NASA Jan. 1971 835 p refs Sponsored by NASA (NASA-SP-7011(85)) Avail: NTIS HC\$9.00 CSCL 06C

A cumulative index is presented of the abstracts contained in NASA SP-7011 (73) through NASA SP-7011 (84) of Aerospace Medicine and Biology: A Continuing Bibliography. It serves as a

current abstracting and announcement journal for references on bioscience and biotechnology. Entries prepared by the two contributing organizations are identified as NASA entries by their STAR accession numbers (N70-10000 series); and AIAA entries by their IAA accession numbers (A70-10000 series). This cumulative index includes a subject index, a personal author index and a corporate source index. Author

**N71-31113\*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena, Propulsion Div.

**PREDICTION OF LIPID UPTAKE BY PROSTHETIC HEART VALVE POPPETS FROM SOLUBILITY PARAMETERS**

J. Moacanin, D. D. Lawson, H. P. Chin (Univ. of Southern Calif.), E. C. Harrison (Univ. of Southern Calif.), and D. H. Blankenhorn (Univ. of Southern Calif.) *In its JPL Quart. Tech. Rev.*, Vol. 1, No. 2 Jul. 1971 p 54-60 refs

Copyright. Avail: NTIS CSCL 06B

Solubility of lipids in silicone rubber and other commonly used poppet materials is assessed. Solubility parameter theory is based on principles derived from thermodynamic considerations. The results of this analysis predict that highly polar compounds, such as phospholipids or proteins, should not be present in silicone rubber poppets, which is in agreement with observations. Author

**N71-31175\*#** Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

**GERMINATION AND GROWTH OF SELECTED HIGHER PLANTS IN A SIMULATED SPACE CABIN ENVIRONMENT Final Report, 9 Apr.-30 Aug. 1970**

Christopher T. Lind Mar. 1971 22 p refs Sponsored in part by NASA

(NASA-CR-119379; AMRL-TR-70-121) Avail: NTIS CSCL 06C

Four species of higher plants including *Raphanus sativus*, *Lactuca sativa*, *Brassica oleracea*, and *Capsicum frutescens* were exposed to an environment simulating the conditions within the NASA Skylab. Seventy-two hundred seeds and four hundred eighty mature seedlings were placed in altitude chambers for a ten-day period. One chamber was held at 260 mm Hg total pressure (27,000 ft) and a duplicate chamber was held at 725 mm Hg total pressure and served as a control. Both chambers had equal partial pressures of oxygen and carbon dioxide. No significant differences in seed germination or seedling development were apparent between the control and reduced pressure treatments. All species obtained a high germination percentage during the ten-day exposure to the simulated space cabin environment. Author

**N71-31201\*+** National Aeronautics and Space Administration, Washington, D.C.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 89, APRIL 1971**

May 1971 134 p refs

(NASA-SP-7011(89)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

**N71-31230\*+** National Aeronautics and Space Administration, Washington, D.C.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 90, MAY 1971**

Jun. 1971 142 p refs

(NASA-SP-7011(90)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

**N71-31231\*+** National Aeronautics and Space Administration, Washington, D.C.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 91, JUNE 1971**

Jul. 1971 99 p refs

(NASA-SP-7011(91)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

**N71-31236#** Louisville Univ., Ky. Performance Research Lab.

**EFFECTS OF 48 HOURS OF CONTINUOUS WORK AND SLEEP LOSS ON SUSTAINED PERFORMANCE Interim Report**

Ben B. Morgan, Jr., Bill R. Brown, and Earl A. Alluisi 30 Sep. 1970 110 p refs

(Contract DAHC 19-69-C-0009)

(AD-722816; ITR-70-16) Avail: NTIS CSCL 5/10

The synthetic-work approach was employed in an investigation of the decrements in performance produced by a 48-hour period of continuous work and sleep loss, and the recovery of performance from these decrements as a result of 24 hours of rest and recovery. Ten Navy and Air Force ROTC cadets worked the tasks of a multiple-task performance (MTP) battery 12 hours a week (in three, 4-hour sessions) during a 4-week training period. Subsequently, they were required to work 2 days according to a 4-4-4-12 schedule, work 48 hours continuously, observe 24 hours of rest and recovery, and finally, work 2 additional days on a 4-4-4-12 schedule. Performance during the 48 hours of continuous work was greatly influenced by the circadian rhythm. The first performance decrements occurred after approximately 18 hours of work; during the early morning hours of the first night, average performance decreased to approximately 82% of baseline performance. During the first half of the second day of work, performance improved to about 90% of baseline, but decreased again during the night to approximately 67% of baseline. All measures of performance indicated that the recovery of performance was complete (to baseline levels) following the 24-hour period of rest and recovery. Author (GRA)

**N71-31237#** Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.

# **AN INVESTIGATION OF THE EFFECTS OF A HELIUM-OXYGEN BREATHING MIXTURE ON HEARING IN NAVAL PERSONNEL**

Day Waterman and Paul F. Smith 18 Sep. 1970 10 p refs  
(AD-722658; SMRL-MR-70-7; NAVMED-MF12.524.004-9012D)  
Avail: NTIS CSCL 6/19

Hearing levels of three subjects were measured at 125, 1000 and 8000 Hertz while the subjects were breathing air and while breathing an 80%/20% mixture of helium and oxygen. No significant change in hearing levels which could be attributed to the effects of the gas breathed were detected during or following a thirty-minute period on helium-oxygen. Author (GRA)

**N71-31238#** Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.

## **THE EFFECT OF INTERMITTENT EXPOSURE TO 3 PERCENT CO2 ON ACID-BASE BALANCE AND ELECTROLYTE EXCRETION Interim Report**

Karl E. Schaefer, C. C. Morgan, Arthur A. Messier, and Michael J. Jacey 16 Jul. 1970 15 p refs  
(AD-722662; SMRL-635; NAVMED-M4306.02-7050B-02) Avail: NTIS CSCL 6/19

The effects of intermittent exposure to CO2 on acid-base balance was investigated. One subject was exposed for six days to increasing CO2 rising at a constant rate from 0.03 to 3.0% CO2 within a period of 15 hours followed by a nine hour period of air breathing. To assess the acid-base parameters arterialized capillary blood was taken from the finger twice daily at 8 AM and 11 PM corresponding with the beginning and end of the intermittent exposure to CO2. Urine specimens were collected at the same times daily while venous blood samples were obtained on alternate days. Hydrogen ion concentrations and PCO2 in the arterialized capillary blood were found increased during the air breathing periods of the fourth and fifth day but returned to normal during the sixth day. The elimination of this CO2 accumulation in the blood was accomplished through renal mechanism showing a marked increase in urine volume, organic acids, titratable acidity, ammonia and hydrogen ion excretion during the fourth and fifth day. The stress effect produced by intermittent exposure to CO2 in this subject must have been minimal since the 17-hydroxysteroid excretion did not change. Author (GRA)

**N71-31271#** Joint Publications Research Service, Washington, D.C.

## **PROBLEM OF DYNAMIC MODELING OF MICROBIOLOGICAL PRODUCTION PROCESSES**

Ya. Kozhesnik 20 Jul. 1971 22 p refs Transl. into ENGLISH from Biofizika (Moscow), v. 16, no. 2, 1971 p 270-284 (JPRS-53634). Avail: NTIS

The mathematical principles of modeling microbiological processes in the biomass, substrate, and inhibitor systems are described. Examples are given of the analysis of models with analog computers. Author

**N71-31334#** Joint Publications Research Service, Washington, D.C.

## **ROLE OF BIOGENIC AMINES (SEROTONIN) IN ONSET OF VESTIBULAR DISTURBANCES DURING FLIGHT**

E. V. Lapayev et al 26 Jul. 1971 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 3, 1971 p 370-374 (JPRS-53678) Avail: NTIS

A study was made of changes in function of the vestibular analyzer and of metabolic changes during flight with artificially

created turbulence, or under the effect of rocking on stands. In flight, there was a decrease in vestibular resistance and changes were observed in metabolism of pyridoxine and serotonin. The involvement of changes in metabolism of pyridoxine and serotonin as a cause of changes in function of the vestibular system was confirmed in studies on stands with simulation of metabolic changes. Author

**N71-31335#** Bunker-Ramo Corp., Thousand Oaks, Calif. Electronic Systems Div.

## **THE CNOCOM/MIS PILOT SYSTEM STUDY Final Report, 1 May 1970 - 30 Apr. 1971**

William D. Wilkinson, Dionisio E. Costales, Dennis J. Sullivan, and Frank E. Hughes Apr. 1971 96 p refs  
(Contract N00014-70-C-0293)  
(AD-722803; D58-1U3) Avail: NTIS CSCL 5/10

Final report describes the results of a study to investigate methods of implementing a pilot or interim man/machine subsystem for the CNO Command/Management Information System and to develop a plan for utilization of that subsystem. Three alternate configurations were examined: a display capability integrated into an existing large scale computer (1108), a display subsystem developed for an existing computer (1410, 7090, or 9300), and a display subsystem developed for a new stand alone processor. A trade-off analysis was performed to evaluate the three alternatives based on seven application specific criteria and the third alternative was recommended. Software modules for the subsystem were specified to include information handling, computational, and graphic display modules. Experimental procedures involving briefings, training, test runs, measurements, and questionnaires were designed in order to evaluate system performance, derive future man/machine configuration requirements and demonstrate system capability to interface with the data base. Author (GRA)

**N71-31336#** Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.

## **PARAMETERS OF HUMAN PATTERN PERCEPTION Semiannual Progress Report, 18 Sep. 1970 - 18 Mar. 1971**

Selby H. Evans 18 Apr. 1971 39 p refs  
(Contract DAAD05-68-C-0176; Proj. Themis)  
(AD-722794; SAPR-7) Avail: NTIS CSCL 5/10

Methodological accomplishments included: The development of a computer program capable of generating comparable Markov and position dependent stimuli from the same prototypes; and the development of a hierarchical computer system which produces insect-like configurations from familiar components for research on storage-aided pattern recognition. Multivariate and traditional experimental approaches were used to explore the effect of statistical properties of pattern components on feature selection. Additional empirical advancements were made in further specifying the effect of knowledge of results on schematic concept formation and in testing a methodology for assessing encoding and storage characteristics of nameable, spatial pattern components. Methodological and empirical results were further extended to the area of individual differences. A multivariate model of feature utilization was specified in greater detail. This class of models was also further extended to a proposed role in the development of an efficient man-machine system for real-world pattern identification. In addition a model for storage-aided pattern acquisitions is being constructed. Author (GRA)

**N71-31481#** Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

## **A COLLATION OF ANTHROPOMETRY. VOLUME 1: A-H**

John W. Garrett and Kenneth W. Kennedy Mar. 1971 1108 p refs  
(AD-723629; AMRL-TR-68-1-Vol-1) Avail: NTIS HC (Individually priced)/MF \$0.95 CSCL 6/16

The collation is a volume 1 of a 2-volume critical comparison of measuring techniques and anthropometric data from 48 American and foreign sources. Approximately 2000 dimensions cover the anthropometry from 16 countries. All titles and descriptions of dimensions from foreign references are presented in the original language as well as in English; in many instances the collation presents translations into English for the first time of classic anthropometric techniques that serve as the basis of the art. The presentation is such that each entry is complete in itself. All equivalent and nonequivalent dimensions of the same or similar title (or description) are cited and explicit differences, if any, are quoted. References to other anthropometric dimensions and data permit easy and quick comparisons, selection of appropriate dimensions, as well as precise understanding of measuring techniques. The data and techniques described are of direct use in the design of all types of equipment requiring the human operator; in the design and sizing of clothing; and will have academic, medical, and other biological applications. GRA

**N71-31499#** California Univ., Livermore. Lawrence Radiation Lab.

**PREDICTION OF THE DOSAGE TO MAN FROM THE FALLOUT OF NUCLEAR DEVICES. 7: ESTIMATION OF THE MAXIMUM DOSE RATE FROM THE CONTINUOUS RELEASE OF RADIONUCLIDES TO THE BIOSPHERE**

Michael W. Pratt 2 Nov. 1970 77 p refs Sponsored by AEC  
(UCRL-50163-Pt-7) Avail: NTIS

A method is described for estimating the maximum internal dose rate to man that could result from the continuous release, at a constant rate, of any given radionuclide to the biosphere. Calculations pertaining to the equilibrium dose rate to bone and whole body are presented to illustrate the method. The results of the analysis are shown to provide a new departure for the establishment of maximum permissible concentration (MPC) values in air and water that take into account the concentration factor associated with the entry of a radionuclide into food chains. They are also shown to be useful as a guide in establishing the maximum rate of radionuclides to the environment that could occur without exceeding allowable dosage limits. Author (NSA)

**N71-31500#** Oak Ridge National Lab., Tenn.

**RADIATION DOSES AT THE ALTITUDE OF SUPERSONIC TRANSPORT FLIGHTS**

O. C. Allkofer and M. Simon Apr. 1971 16 p refs Transl. into ENGLISH from Atompraxis (Karlsruhe, West Ger.), v. 16, 1970 p 186-195 Sponsored by AEC  
(ORNL-tr-2455) Avail: NTIS

Supersonic transport flights (SST) will take place at an altitude of 19 to 25 km, which may result in exposure of the personnel to radiation doses in excess of the permissible dose of 5 rem/yr. Estimates were made of the radiation dose rates due to cosmic radiation, heavy primary particles, and solar radiation at this altitude. The special problem of very strong solar flares that occur only rarely is discussed. It was concluded that the yearly flight time for the crew of a supersonic aircraft might possibly be limited by the radiation dose and dose rate encountered during some flights. NSA

**N71-31526#** Aviation Medical Research Unit.

**DRB AVIATION MEDICAL RESEARCH UNIT REPORTS, VOLUME 1, 1964-1968**

Geoffrey Melvill Jones, comp. May 1971 204 p refs Reprinted (DR-208-VOL-1) Avail: NTIS

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**N71-31527#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**DYNAMICS OF THE SEMICIRCULAR CANALS COMPARED IN YAW, PITCH AND ROLL**

Geoffrey Melvill Jones, W. Barry, and N. Kowalsky In its DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 1-11 refs Repr. from Aerospace Med., no. 35, 1964 p 984-989;

(AMRU-R-64-1: A64-27607) Avail: NTIS

Treating the semicircular canal system as a 3-D sensing

device experiments were performed to compare the patterns of response to rotational stimuli in the yaw, pitch, and roll planes of the head. The method of post-rotational stimulation on an electronically controlled turntable was used, both subjective cupulometry (S) and objective measurement of slow phase eye angular velocity (O) being employed to measure the time course of response decay. The mean time constants obtained from (S) in yaw, pitch and roll were 10.2 (+ or - 1.8), 5.3 (+ or - 0.7), and 6.1 (+ or - 1.2) respectively, the corresponding values from (O) being 15.6 (+ or - 1.2), 6.6 (+ or - 0.7), and 4.0 (+ or - 0.4). It is concluded that the effective time constants of post-rotational decay in the planes of pitch and roll are considerably shorter than in yaw. Numerical examples are given of the penalty to be expected from these data. Author

**N71-31528#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**PREDOMINANCE OF ANTICOMPENSATORY OCULOMOTOR RESPONSE DURING RAPID HEAD ROTATION**

G. Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 12-19 refs Repr. from Aerospace Med., no. 35, 1964 p 965-988;

(AMRU-R-64-2; A64-27603) Avail: NTIS

Experiments with human subjects are described which show that when the head is jerked with high angular velocity, say to the right, large anticomensatory flicks drive the eyes well over in the leading direction, in this case to the right, where they remain until the head slows down. Then the expected compensatory response to the left begins to appear. If the high head angular velocity is artificially maintained, as on a turntable, the expected compensatory response may be virtually eliminated for several seconds, presumably owing to prolonged action of a strongly maintained anticomensatory response. It is suggested that vestibular signals can exercise a substantial measure of control over the quick, anticomensatory, phase of nystagmus. Author

**N71-31529#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**THE CRITICAL DEPENDENCE OF SEMICIRCULAR CANAL FUNCTION UPON ITS PHYSICAL DIMENSIONS**

Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 20-25 refs Repr. from Proc. Intern. Symp. on Vestibular and Oculomotor Probl. (Tokyo), 1965 p 57-61

(AMRU-R-65-1) Avail: NTIS

It was found that as the size of a tube carrying fluid flow decreases, the ratio of viscous forces to those due to inertia rapidly increases. Angular velocity transduction was observed as the main functional role of canals critically dependent on dimensions. It is shown that the canal is always matched to the frequency range to which the head will be exposed in natural life. J.A.M.

**N71-31530#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**DISTURBANCE OF OCULOMOTOR CONTROL IN FLIGHT**

Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 26-34 refs Repr. from Aerospace Med., no. 36, 1965 p 461-465;

(AMRU-R-65-2; A65-24082) Avail: NTIS

An over-all analysis of the physiological processes contributing to stabilization of the retinal image reveals four sensory and three motor information channels. Visual tracking and vestibulo-ocular

mechanisms disclosing a number of limitations imposed on the over-all system by the flight environment are considered. Frequency response of visual tracking, virtual absence of visual tracking in the roll plane, and the vestibular errors is introduced by prolonged turning and the predominance of an anticomensatory vestibulo-ocular response during rapid head rotation. Author

**N71-31531#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**SPATIAL AND DYNAMIC ASPECTS OF VISUAL FIXATION**

Geoffrey Melvill Jones and J. H. Milsum *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 35-51 refs Repr. from IEEE Trans. Bio-Med. Eng., no. 12, 1965 p 54-62;

(AMRU-R-65-3; A65-26978) Avail: NTIS

The physiological processes concerned with the difficult dynamic task of fixating the retinal image during normal body and head movement are examined with a control engineering perspective. Spatial relationships between the two system inputs (visual and vestibular) and three outputs (operating on the eye-in-skull, skull-on-body, and body-in-space platforms) are examined in the context of the geometry of the environment with the aid of an information flow diagram. With head free, the added perturbations of natural movement exceed tracking capabilities. Over the frequency range 0.1-5.0 c/s the semicircular canal subsystem then provides angular velocity information for powerful complementary servostabilization. Author

**N71-31532#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**THEORETICAL MAN-MACHINE INTERACTION WHICH MIGHT LEAD TO LOSS OF AIRCRAFT CONTROL**

J. F. Martin and Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 52-59 refs Repr. from Aerospace Med. no. 36, 1965 p 713-717;

(AMRU-R-65-4; A65-32628) Avail: NTIS

A theoretical model is developed for a pilot-aircraft interaction wherein the pilot relies entirely upon his sense of the relative gravity vector for orientation information. It is shown that the illusory effects arising from motions could cause him to operate the aircraft controls in a diametrically opposite manner to what would be appropriate. This model may serve as a basis to account for otherwise unexplained losses of control in jet transport aircraft. Author

**N71-31533#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**INFLUENCE OF EYE LID MOVEMENT UPON ELECTRO-OCULOGRAPHIC RECORDING OF VERTICAL EYE MOVEMENTS**

W. Barry and Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 60-66 refs Repr. from Aerospace Med., No. 36, 1965 p 855-898;

(AMRU-R-65-5; A66-17662) Avail: NTIS

The cause of an EOG artifact noted during vertical saccadic eye movements was investigated. Records of eye movements were simultaneously obtained from dc electro-oculography and a movie photographic method in response to intermittent vertical saccadic changes in visual fixation. The artifact was found to run the same time course as the upper eye lid movement and is probably directly attributable to this. An argument is advanced suggesting that changes in the relative position of the eyelid and eyeball are



responsible for the artifact, and a simplified model of the electrical setup by which the eyeball, lids and electrodes might function is presented. Author

N71-31534# McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**THE VESTIBULAR CONTRIBUTION TO STABILIZATION OF THE RETINAL IMAGE**

Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 67-78 refs Repr. from Proc. of NASA Symp. on the Role of the Vestibular Organs in the Exploration of Space, 1965 p 163-172; :

(AMRU-R-65-6; Avail: NTIS

The vestibulo-ocular reflex system is examined as an essential backup to the visual fixation reflex. The vestibular stimulus is seen as the output from an angular velocity transducing hydrodynamic system, feeding the central nervous system with angular velocity modulated information, provided the mechanical stimulus is confined within a specified frequency range. The central nervous angular velocity signal is envisaged as driving an angular velocity control system through the physiology of the oculomotor system. It appears that the dynamic response of the vestibulo-ocular system improves as that of the visual tracking systems fails, to the extent that the former operates with a gain of 1 at frequencies associated with failure of the latter. Author

N71-31535# McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**THE INTERDEPENDENCE OF CLINICAL NEUROLOGY AND NEUROPHYSIOLOGY: AN HISTORICAL REVIEW OF THE VESTIBULO-OCULAR REFLEX**

Seymour Mishkin *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 79-91 refs Repr. from McGill Med. J. (Montreal), 1966 p 80-97

(AMRU-R-66-1) Avail: NTIS

Early theories of neurophysiology based on empirical data are reviewed. With the discovery of basic neurological mechanisms, specific experimental designs were applied in vestibulo-ocular reflex research. J.A.M.

N71-31536# McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**VESTIBULAR INAPTITUDE IN THE ENVIRONMENTS OF FLIGHT AND SPACE**

Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 92-105 refs Repr. from J. Laryngol. Otol. (London), no. 53, 1966 p 207-221;

(AMRU-R-66-2) Avail: NTIS

The vestibular system associated with body movement, particularly the head, is examined in an aerospace environment. The exaggerated effects of angular and linear acceleration on the body are discussed, along with the physiological effects on the otolith organs, semicircular canals associated with the central nervous system, and the vestibulo-ocular reflex. J.A.M.

N71-31537# McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**INTERACTIONS BETWEEN OPTOKINETIC AND VESTIBULO-OCULAR RESPONSES DURING HEAD ROTATION IN VARIOUS PLANES**

Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 106-117 refs Repr. from Aerospace Med., no. 37, 1966 p 172-177; :

(AMRU-R-66-3; A-22583) Avail: NTIS

Subjects were accelerated on an electronically controlled turntable to a chosen angular velocity which was then maintained constant for 3 minutes and finally decelerated to a standstill. They either had their heads tilted backwards, or sideways, at 45 deg to the vertical axis of the turntable. Thus they were simultaneously exposed to equal angular velocity stimuli in the skull planes either of yaw and roll, or of yaw and pitch. The eyes were open and looking at an appropriate stationary optokinetic stimulator. Measurement of compensatory eye angular velocities in the relevant planes with a movie-photographic technique revealed very poor optokinetic following in the roll plane and hence wide dissociation of oculomotor responses in yaw and roll. In yaw and pitch the components of eye angular velocity were always equal to one another, despite failure to reach the numerical value required for visual fixation. Author

N71-31538# McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**PREDOMINANT DIRECTION OF GAZE DURING SLOW HEAD ROTATION**

Seymour Mishkin and Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 118-125 refs Repr. from Aerospace Med., no. 37, 1966 p 897-901;

(AMRU-R-66-4;

Avail: NTIS

Experiments with human subjects oscillated sinusoidally about a vertical axis have shown that on superimposed nystagmoid pattern of response, there tends to be a slow waveform change in the average eye position relative to the skull. In these experiments, this waveform had the same frequency as the oscillatory motion of the head but was approximately 90 deg phase advanced. This implies that during the sinusoidal head motion the waveform defining averaged eye position relative to the skull was approximately in phase with head angular velocity. Author

N71-31539# McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**DEPENDENCE OF VISUAL TRACKING CAPABILITY UPON STIMULUS PREDICTABILITY**

Joel A. Michael and Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 126-137 refs Repr. from Vision Res. (London), no. 6, 1966 p 707-716

(AMRU-R-66-5) Avail: NTIS

Variable, narrow bandwidths of random noise were used to determine the ability of the human visual tracking system to maintain fixation on moving stimuli of various degrees of predictability. The results indicate that there is a continuous relationship between stimulus predictability and tracking capability; the less predictable the stimulus motion, the greater the phase shift between stimulus and response at a given frequency. Thus, a predictive component in the system operating in the unpredictable mode and permits pattern following of head and target movements. Author

N71-31540# McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**NEURAL REFLECTION OF VESTIBULAR MECHANICS**

G. Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 138-151 refs Repr. from Proc. of 3d NASA Symp. on the Role of Vestibular Organs in the Exploration of Space, 1967 p 169-182;

(AMRU-R-67-1;

Avail: NTIS

The semicircular canal function during natural angular head movements is investigated, including hydrodynamic components of the canal performing under angular acceleration. Studies were performed using singular and combined vestibular stimuli which resulted in uncertainty in the physiological responses. The effects of linear acceleration and a directional change of the linear acceleration vector are also examined. J.A.M.

**N71-31541#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**THE PHYSIOLOGICAL ADAPTATION TO UNILATERAL SEMICIRCULAR CANAL INACTIVATION**

Hyman Zuckerman *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 152-157 refs Repr. from McGill Med. J. (Montreal), v. 36, no. 1, Feb. 1967 p 8-13.

(AMRU-R-67-2; A67-81039) Avail: NTIS

Normal unanaesthetized cats were subjected to a range of oscillatory rotational stimuli, their heads fixed to the rotating platform, with the horizontal canals in the plane of rotation. The same cats were then subjected to similar stimuli at intervals after unilateral obstruction of the canal. As opposed to unilateral labyrinthectomy, this procedure does not interfere with ampullary afferent innervation leaving the steady state condition unimpaired. Results are presented showing a consistent fall in gain of the overall vestibulo-ocular response by a factor of 2 in post operative animals. All stimuli were conducted in absolute darkness. Author

**N71-31542#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**SOME AVIATION MEDICAL ASPECTS OF FLIGHTCREW FATIGUE**

Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 158-170 refs Repr. from the publ. 'A Study of the Legal Aspects of Flight Crew Fatigue' by Vivian C. Slight Montreal, McGill Univ., Inst. of Air and Space Law, 1967

(AMRU-R-67-3) Avail: NTIS

The stressing aerospace environments are reviewed causing fatigue in flight crews. The short time or transient effects associated with continued exercise of a skilled task, the long term effects which accumulate during extended periods of over work, and the unpleasantness of going without sleep are considered. The legal control in matters affecting flight crew fatigue is also discussed, including aircraft service ability, inspection schedules, design criteria, and navigational constraint. J.A.M.

**N71-31543#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**A DYNAMIC MODEL OF THE SEMICIRCULAR CANAL**

Robert F. Stevenson *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 171-174 refs Repr. from McGill Med. J. (Montreal), 1968 p 54-58

(AMRU-R-68-1) Avail: NTIS

Particle movements are recorded in response to changes in angular velocity. The canal velocity was plotted, and a comparison was made with the flow patterns using a frame-by-frame analysis. Vestibular nerves correlated with the fluid flow within the semicircular canals are studied as a function of fluid viscosity, fluid inertia, and the restoration force exerted on the fluid displacement by the cupula. J.A.M.

**N71-31544#** McGill Univ., Montreal (Quebec). Aviation Medical Research Unit.

**FROM LAND TO SPACE IN A GENERATION: AN EVOLUTIONARY CHALLENGE**

Geoffrey Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 1, 1964-1968 May 1971 p 175-198 refs Repr. from Aerospace Med., no. 39, 1968 p 1271-1283.

(AMRU-R-68-2; A-69-14067) Avail: NTIS

A state of the art review is presented on the effects of angular velocity and linear acceleration of visual perception. The neurophysiological aspects of semicircular canal velocity affecting eye and head movements of personnel in aerospace environments are given. Simultaneous records of yaw, roll, and pitch eye movements relative to the skull obtained during recovery from an eight turn spin in a jet trainer aircraft are also included, as well as a movie camera design for 3-D recording of eye movements in flight. J.A.M.

**N71-31587#** Arizona State Univ., Tempe.

**EFFECTS OF HYPERBARIC ENVIRONMENTS ON NEUROMUSCULAR CONTROL IN PRIMATES**

Dwight Sutton, Eugene M. Taylor, and Jerry D. Burns 1 Apr. 1971 41 p refs

(Contract N00014-68-A-0150; Grant RR-00166)

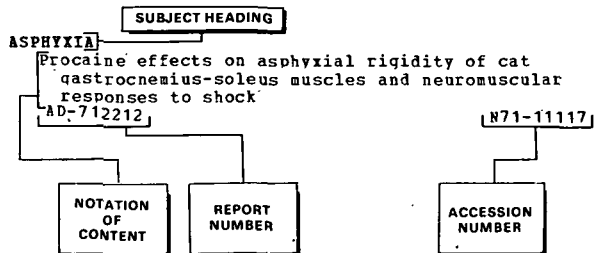
(AD-723829; TR-71-01) Avail: NTIS CSCL 6/19

Four monkeys were individually exposed to hyperbaric environments consisting of air, nitrogen-oxygen ( $pO_2 = 200$  mm Hg), and argon-oxygen ( $pO_2 = 200/1000$  mm Hg). Neuromuscular control was assessed via a force discrimination task during the course of simulated dives lasting 7-16 hrs. Performance decrements were related to depth and to gas mixtures. Task failure occurred at 400-500 FSW with argon-oxygen. Air was tolerated at pressures equivalent to 500-700 FSW. Nitrogen-oxygen produced total failures in force discrimination at 600-800 FSW. During compression, performance efficiency was often sustained, although other measures indicated neuromuscular control problems at relatively low pressures. Adaptation to intermediate pressures was exhibited by recovery of effectiveness in performing the force discrimination task. Related measures of cardiac function in waking monkeys revealed stability over all the pressures and gas mixes utilized in the study. The study indicates that the expression of inert gas narcosis relates to  $pO_2$  of the breathing gas and that the condition is not clearly related to unusual cardiovascular adjustments. Author (GRA)

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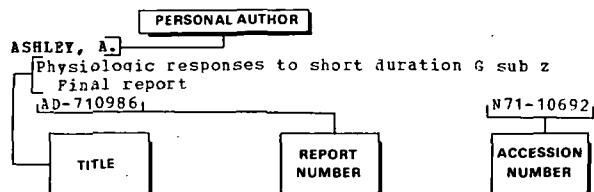
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